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A CONTRIBUTION TO THE STUDY OF ANOPHTHALMIA WITH DESCRIPTION OF A CASE*

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A STUDY of the literature reveals that not many examples of anophthalmia have been subjected to microscopical examination, and that only a few of these are of recent date. The investigation of a particular case—itself of some special interest—suggests that the nature of anophthalmia and the interpretation of previous observations are worthy of further discussion in the light of modern views on histogenesis. In this paper, therefore, I intend to discuss some general problems which have not, perhaps, received sufficient attention in the past, reserving an account of changes in the visual pathways and centres for another publication.

The material on which this paper is based was obtained by Dr. R. F. Ogilvie, of the Pathology Department, University of Edinburgh, and given by him to Professor Brash, who placed it at my disposal; I am very much indebted to them both for the opportunity of research thus afforded to me.

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Material

A full-term male child was born September 7, 1940, with a left-sided hare-lip and apparent lack of the left eye. There was difficulty in sucking and swallowing, and the child was admitted to hospital when ten weeks old; but its condition rapidly worsened, and it died one week later, November 21, 1940. The body was emaciated, and the autopsy disclosed miliary tuberculosis of nearly all the organs.

Figs. 1 and 2 show the abnormalities present in the facial region. The left side of the mouth is enlarged and the hare-lip is evident as a small V-shaped cleft pointing to the left orbit and connected to it by a slight groove in the skin. Another groove extends from the right angle of the mouth to the right ear; the right two-thirds of the upper jaw, *i.e.*, the part to the right of the hare-lip, projects beyond the mandible, and the nose slants downwards to the right. The right orbit and eyeball appear normal, but there is no sign of the left eyeball. No malformations were found in any other region of the body.

The complete facial region, including the intact orbits, was available for investigation, and the brain, fixed in Kaiserling's fluid, was received complete.

Macroscopical observations.—The left palpebral fissure is narrower and shorter by 6·5 mm. than the right, as the eyelids fuse together near the lateral angle (Fig. 1). The medial angle is divided by a ridge of skin that begins in the shallow groove connecting the orbit with the hare-lip, and runs upwards and laterally into the conjunctival cavity. It ends by joining an irregular sub-conjunctival elevation which divides the cavity into upper and lower slightly deeper portions. At the lateral end of the ridge a black spot is visible through the conjunctival covering.

The general arrangement of the contents of both orbits was examined by dissection. The right orbit was entirely normal, and in the left the extrinsic muscles of the eyeball, the III, IV, V(1) and VI nerves, the ciliary ganglion, the lacrimal gland and the branches of the ophthalmic artery were found in approximately normal positions. But the left ophthalmic artery is about one-third narrower than the right, and the left optic nerve is completely absent. No trace even of a fibrous strand, such as has been described running to the optic foramen or beyond it, was found. The foramen itself, distinctly smaller than on the right side, was just wide enough to transmit the ophthalmic artery—the only structure that passed through it. The left orbit as a whole is distinctly smaller than the right; the difference in capacity, obtained after removal of contents by making casts and measuring

their displacements, is 3 c.cm. The left naso-lacrimal canal was closed by a thin membrane at its nasal end.

The right eyeball with its optic nerve and the contents of the front part of the left orbit (including the ridge which has been described, the conjunctival covering, lacrimal canaliculi, etc.) were embedded in celloidin, cut horizontally (40μ) and stained by Van Gieson's and Masson's methods; the complete serial sections of the left orbital contents were stained alternately by these methods.

Microscopical observations.—The right eyeball, in particular the retina proper and the pigmented layer, is structurally normal, and some of the contents of the left orbit are normal in appearance. The left lacrimal gland is well-developed with a palpebral process and numerous small accessory glands, mainly in the fornices and round the corneal border. The lacrimal puncta and canaliculi are present in both eyelids, but the inferior canaliculus bifurcates to form two parallel channels. These open, with the superior canaliculus, into a sac-like enlargement which, like the canaliculi, is lined with stratified epithelium. It has a narrow, blind upper end, and its lower part opens into the lacrimal sac, more spacious than the right, and made up of several pouch-like dilatations, incompletely separated by very thin walls, the whole lined with columnar epithelium.

The bottom of the conjunctival cavity is composed of dense fibrous tissue with many interlacing collagenous and elastic fibres, and is covered with stratified cuboidal epithelium with goblet cells. Into this fibrous tissue the orbital muscles are inserted in more or less normal relative positions. The elevation at the bottom of the conjunctival cavity appears in the horizontal sections as a projection composed of the same dense connective tissue (Fig. 3), with a short, narrow extension backwards into the orbit. The end of this extension receives the insertion of the inferior rectus muscle, and a small piece of cartilage lies medial to it. Over the elevation the stratified epithelium has fewer cell-layers than elsewhere and the most superficial consists of squamous cells.

The ridge that runs from the medial angle of the eye displays a skin-like structure with hair-follicles and sebaceous glands (Figs. 3 and 4); but the contents of the sub-conjunctival projection, with which the ridge fuses, are at first sight puzzling. Centrally there is an agglomerate mass—about 2 mm. in diameter—of plain muscle, nerve-fibres, capillary vessels, melanin clusters and structures like rods or ducts impregnated with melanin pigment. Around this mass numerous melanophores and scattered specks of melanin lie in the fibrous tissue (Fig. 3). Careful examination of the lower sections shows that a narrow prolongation of the mass of melanin pigment becomes superficial at the place where

the skin ridge joins the subconjunctival elevation. It seems to end in a small cleft-like space, lined also with pigment and filled with homogeneous coagulum (Fig. 4). This corresponds to the black spot already noted. No vestiges of retinal structure, of optic nerve, of lens or of hyaloid artery could be found in the left orbit.

Discussion

Our analysis of the contents of the left orbit shows that the mesodermal structures, situated external to the eyeball, are well developed, but that the eyeball itself is represented only by its anterior part, recognisable as vestiges of cornea and sclera, of muscle and vessels. Of the parts to which the surface ectoderm gives rise we find vestiges of everything but the lens. In the lacrimal apparatus, as already stated, only slight maldevelopments are evident, and the skin-like ridge may be regarded as nothing more than a malformed, enlarged lacrimal caruncle which covers the semilunar fold. The change in the epithelial covering, with the lack of goblet cells where the ridge fuses with the subconjunctival elevation, indicates that this is the region of the corneo-scleral junction.

Such a congenital ridge on the surface of the eyeball was observed by Fisher (1904). He considered it to be an embryonic skin-fold of the eyeball which, on account of its superficial position, had not been converted into conjunctiva. Also Ida Mann (1937), discussing palpebral coloboma, says: "Often bands or bridges of skin and conjunctiva arise from the region of the gaps and are joined to the eye (cornea or conjunctiva). . . . Sometimes, instead of a gap, the inner or the outer canthus may be absent, its place being taken by a smooth crescentic edge and a pterygium-like fold of thickened conjunctiva which stretches from this to the limbus" (p. 399); and further, "Sometimes a defective inner or outer canthus is occupied by a small dermoid growth which may have prevented the canthus from forming" (p. 402).

In our case this ridge is of special interest because, first, it is joined to the part of the conjunctival cavity which structurally appears to be a rudimentary corneo-scleral junction, and, secondly, it extends to the region of the agglomerate mass of melanin, capillary vessels, plain muscle and nerve-fibres which doubtless are the remnants of the ciliary body. But the appearance of the melanin pigment in clusters and rod-like or duct-like form makes it difficult to determine its origin (Fig. 5). The method of Alfieri —blanching the pigment and then staining with haematoxylin and erythrosin—shows, however, that the single "rods," or double "rods" that look like "ducts," are actually one or two layers of cuboidal epithelial cells with distinct nuclei (Fig. 6). This arrangement of cells is characteristic of the retinal pigment layer,

Explanation of Plate

Fig. 1 —Frontal view showing malformations of the face described in the text

Fig. 2.—Profile showing more distinctly the position of the ridge in the medial canthus of the left eye.

Fig. 3.—Horizontal section through the subconjunctival (sclero-corneal) projection and the ridge showing the agglomerate mass of melanin pigment and other structures described in the text. ×12.

Fig. 4.—Horizontal section below the preceding. The pigment mass reaches the subconjunctival cleft, and the vestiges of ciliary body and pigment clusters are seen in the centre of the section. ×12.

Fig. 5.—Section showing the duct-like streaks of melanin pigment. ×82.

Fig. 6.—The next section after blanching by Alfieri's method and subsequent staining by haematoxylin and erythrosin The epithelial arrangement of cells is clearly visible. ×82.

Figs. 3, 4 and 5 are from sections stained by Masson's method (haemalum, eosin, saffron).

and we infer that the cells are melanoblasts derived from the pigment epithelium of the optic cup. In addition there are melanophores of mesodermal origin and clumps of free pigment in the tissue.

We have seen that this whole enigmatic mass extends to a space under the conjunctival covering by a narrow process that passes through the connective tissue at the corneo-scleral junction. It seems that there must have been a gap, as in the rare congenital coloboma sclerae ad limbum, with the formation of a subconjunctival cyst which is now seen as a little cleft filled with fluid.

Colobomata and cysts in this situation are very rare. One was cited by Fuchs (1924), who referred to a note of Harrington: "Coloboma of the sclera appearing as a fissure at the sclero-corneal junction with a tumour-like protrusion of the choroid has been described. The tumour was reduced and a gap covered with conjunctiva" (p. 618). In our case the relation of one end of the skin-ridge to a malformed and enlarged lacrimal caruncle and the lower eyelid, and of the other end to the sclero-corneal junction and the subconjunctival cyst suggests the possibility that we may be dealing with a kind of dermoid that divides the medial canthus in two.

Of cases in which, with or without a cyst, aggregations of pigmented tissue have been observed microscopically I can find only 14 in the relevant literature: 10 human—Haab (1881), Zimmermann (1893), van Duyse (1899), Bietti (1901), Hanke (1904), Cecchetto (1920), Triepel (1921), Gallemearts (1924), Recordon and Griffiths (1938), Whitnall and Norman (1940); and 4 in animals—de Bary (1887) and Albrecht (1895) in the calf, Collins and Parsons (1903) in the chick, and the Chases (1941) in mice. Some similar cases are cited by other authors also, but from clinical examination only. Of the authors mentioned, Bietti, Whitnall and Norman, Triepel and the Chases consider the pigment to be neuro-epithelial in origin; Gallemearts describes only the form of the cells as "polyedrique"; van Duyse, Collins and Parsons, Hanke, and Recordon and Griffiths, on the contrary, believe that the pigment is mesodermal. The others do not touch the problem of the origin of the pigment. Hanke alone blanched his sections, and his opinion was that "die nach Fick depigmentierten Präparate bewiesen dass die Zellen jedes epithelialen Charakters entbehren". Ida Mann (1937), describing primary anophthalmia, says, "The mass of fibrous tissue represents the sclerotic and having in its centre a cavity containing a small amount of pigmented vascular tissue representing the choroid with its mesodermal pigment" (p. 67); and further, discussing degenerative anophthalmia, she says with some reserve, "It is possible that those cases in which a fibrous nodule, containing pigmented tissue but no nervous

elements, is found with the extrinsic muscles attached to it, belong actually to this group, since it is difficult to be absolutely sure that the pigment in these cases is entirely mesodermal in origin" (p. 70).

In our case the location and the features of the pigmented masses give at first sight the impression that they are of mesodermal origin. But the appearance of the blanched sections confirms the view that they are neuroblastic derivatives. It may be that in all the cases so far described—in spite of some contrary opinions (van Duyse, Hanke)—the pigment cells, after good blanching and subsequent staining, could have been proved to be of neuroblastic origin. The melanophores only were evidently mesodermal.

The neuroblastic origin of melanoblasts finds confirmation in the researches of Wieting and Hamdi (1907) and of Masson (1926-1931). The former authors showed that melanin pigment develops either directly, or indirectly through nervous tissue, from the ectoderm. The investigations of Masson on melanin tumours proved the neurogenic character of their pigment cells. According to this author the melanin pigment in epithelium or in connective tissue is developed in close connection with the cells related to nerve-endings and then migrates into the epithelium or is dispersed by means of melanophores which function as phagocytes of the pigment.

It is well known that the conjunctiva, even in the white races, is capable of producing melanin pigment, particularly in the region of the corneo-scleral junction. According to Masson the nerve-endings in the conjunctiva participate in this process. It is possible, therefore, that in our case the optic cup did not develop at all, and that the melanin masses are of conjunctival nerve-ending origin. Or these masses might be a kind of melanin dermoid united to the remnants of the ciliary body by means of a malformed lacrimal caruncle. A third possibility is that the melanin masses developed in the nerve-endings of the ciliary body and afterwards collected on the walls of the colobomatous cleft and cyst. But the blanched sections which show the typical epithelial character of the cells, particularly in the deeper parts of the melanin aggregations, negative all these suggestions.

We can now distinctly characterise our case: The original abnormality must have occurred about the 5 mm. stage, *i.e.*, the stage at which the invagination of the primary optic vesicle should take place. But the only trace of the vesicle is the pigment epithelium, and there is no lens. The case might therefore be diagnosed as anophthalmia with vestiges of cyst (congenital cystic eye).

There are three main types of the malformations called anophthalmia or microphthalmia: (1) All parts of the eyeball are present, underdeveloped or malformed; (2) neither neuroblastic nor ectodermal structures (retina, pigment epithelium, lens) can be discovered, and only mesodermal parts of the eyeball, mostly malformed, are present; (3) neither retina proper nor lens nor vitreous body are to be found, but pigment epithelium is present and also the mesodermal parts, more or less developed. This third type suggests that the retina proper, vitreous body and lens are associated in some way in their development, but that the development of the pigmented layer is independent of the retina proper and related, in spite of its neurogenic origin, to the development of the mesodermal tissues that surround the optic vesicle. Consequently the following problems arise:—

1. Why in such cases does the pigment epithelium (*i.e.*, the outer layer of the optic cup, one part of the optic vesicle) remain, although sometimes malformed?

2. Why can no trace of the retina proper (*i.e.*, the inner layer of the cup, part of the same optic vesicle) be discovered in the vestiges of the eyeball?

The earlier writers on the subject do not touch on these problems, but make suggestions concerning only the cause of anophthalmia or microphthalmia as a whole. Among recent authors, Ida Mann (1937) defines degenerative or consecutive anophthalmia as including those cases in which "an optic outgrowth appears to have formed and subsequently to have degenerated" (p. 70). In the passage previously quoted she does not exclude the epithelial origin of pigment when it is found without nervous elements, but she does not try to explain how this may be possible. The Chases (1941) write, "A lens is absent and the optic cup may be absent or represented by a streak of pigment" (p. 286), and further, "If a lens does not form and the cup collapses but yet proceeds far enough to allow pigment to develop in the outer wall, a mass of pigment will usually result in the adult" (p. 287).

This interpretation might be of value if the normal development of the pigment actually depended on the cup itself, but that is not the case. This fact leads us to seek some other explanation in the normal development of the various parts of the eye, and particularly in the development of its blood-supply. We know that a local capillary network develops, about the 4-5 mm. stage, in the mesenchymal tissue that surrounds the optic vesicle and optic stalk, and that the arteries of the developing eye arise later from this local capillary network and not as new branches budding from a larger vessel. Thus two main vessels, each of which supplies one of two groups of the constituent parts of the eyeball, arise independently, but later join to form the common ophthalmic

artery. One of these is the hyaloid artery, the primordium of which sinks immediately into the fissure of the optic stalk and cup. The other vessel—the ophthalmic artery proper—ramifies on the mesodermal surface of the optic vesicle, or later the optic cup, and afterwards reaches the brim of the cup, where its capillary branches form the annular vessel that anastomoses with the distal ramifications of the hyaloid artery. The latter supplies only retina, vitreous body and lens, while the former supplies all the mesodermal covering and also the pigment epithelium. The further development of the pigment epithelium takes place, therefore, in the same conditions, as regards blood-supply, as the surrounding mesodermal tissue and in very intimate relation with it; at their contiguous surfaces the first choroidal capillaries develop, to form the chorio-capillaris layer; and it is in relation to the capillary blood-supply that the neuroblastic epithelial cells show the first appearance of melanin pigment.

This suggestion is confirmed by several writers on the development of the circulation in the eye. For example, Ida Mann (1928), in her monograph, "The Development of the Human Eye", which provides a minute study, with excellent drawings and reconstructions of the various stages of the circulation, does indeed take into account the intimate relation between pigment epithelium and the chorio-capillaris layer, saying: "The choroidal net seems to develop wherever mesoderm is in contact with pigmented epithelium. It appears *pari passu* with the pigment and appears to be in some way related to this, in that if for any reason pigment is absent over an area of the surface of the optic cup, the choroid is absent also. . . . Whether the presence of pigment is determined by the development of the choroid or *vice versa* is not definitely proven, as they seem to appear almost simultaneously" (p. 39).

Pedrals (1943) illustrates his recent paper on the development of the anterior chamber of the eye with photo-micrographs and drawings of sections of rabbit and mouse embryos which show exactly the independence of the two sources of blood-supply. This author is of opinion that the primary annular vessel is arterial and arises directly from the ophthalmic artery and not from the hyaloid artery. ("El primer vaso anular es de naturaleza arterial, por su derivación directa de la arteria oftálmica y no de la arteria hialoidea", p. 82). The fact that the pigmented, retinal layer of the iris gives rise to the sphincter pupillae muscle, the further development of which depends on blood-supply from branches of the ophthalmic artery, provides another example of the intimate relation between the pigment epithelium and that artery.

Although they do not touch our problem directly, some interesting observations on the lamina chorio-capillaris by Reichling and

Klemens (1937, 1940) may be cited. In the eyes of almost all people over 55 years they have found a new vascular connective tissue layer between the pigment epithelium and the basal lamina of the choroid; and they show that this new layer is developed from vessels of the chorio-capillaris that pierce the basal lamina.

The development of a normal circulation is most probably governed partly by inherited factors and partly by hydrodynamic conditions in the tissues. Minor deflections from the normal circulatory pattern do not necessarily disturb the normal development of an organ or part of the body, but greater deflections may do so. We do not know the reason for this; but there may possibly be a genetic inhibitory influence on the dynamics of cells in the mesodermal haematogenic tissue so that they are unable to create favourable conditions for the further development of "blood-islands", of capillary networks, or of vessels of sufficient calibre and length. Such disturbances must be detrimental to the progressive growth of established primordia of structures, through inadequate blood-supply. With particular reference to the problem under discussion, the noxious genetic factor would thus act not directly on the neuroblastic and ectodermal structures (future retina and lens), but indirectly through its effect on the mesoderm which normally gives rise to the hyaloid artery.

The features and course of the central artery of the retina in the adult support the view that the hyaloid artery develops independently. The central artery of the retina is essentially a branch of a cerebral artery, whereas the ophthalmic artery may have some other origin, e.g., as a branch of the middle meningeal artery*.

The hyaloid artery supplies not only the inner layer of the optic cup, but also the optic stalk, which must be affected, too, by lack of this artery or its inadequate development. The stalk becomes the optic nerve as the various layers of neurones, including the ganglion cells, develop in the retina, and as the axones of these cells leave the retina to become fibres of the optic nerve, of part of the chiasma and of the optic tracts. It is evident that in anophthalmia the whole peripheral visual neurone, at least as far as the lateral geniculate body, must be undeveloped. Sometimes a strand of connective tissue may be seen as a vestige of an atrophied optic stalk.

The independence of the blood-supply of the two territories in

* I have found that there is a comparable arrangement in the dog and the pig: the so-called external ophthalmic artery takes origin from the internal maxillary artery and gives off the same extra-ocular branches as the ophthalmic artery in man. It anastomoses with the so-called internal ophthalmic artery, which arises from the internal carotid by a single small branch. See also Ellenberger's Handbuch der Anatomie der Haustiere (1926), and Bradley's Topographical Anatomy of the Dog (1943). The latter author says that the central artery of the retina arises from the anastomosis between the external ophthalmic artery and a twig of the internal carotid, the so-called internal ophthalmic artery.

the developing eye may serve to explain why teratological lesions may occur in one or the other separately; and a common blood-supply may explain likewise why retina and lens, although different in origin, should be simultaneously absent, while, in the same cases, the pigment epithelium and mesodermal structures, also different in origin, may both be present. In such cases the absence of the retina has probably led many authors to take for granted the mesodermal origin of the melanin pigment they have found, without an exact analysis of its epithelial character or even reference to its situation. But it should be remembered that most of these investigations were made without our present knowledge of melanin pigment.

There has been a failure, too, to distinguish between anophthalmia and microphthalmia. Cases with similar microscopical findings or examined only clinically have been published indifferently as anophthalmia or microphthalmia. In recent years two classifications of these lesions have appeared. Ida Mann (1937) distinguishes in the first place between primary and secondary anophthalmia, due respectively to failure of the optic outgrowth itself and to " suppression or abnormality of the whole of the fore-brain "; and she recognises a third type, consecutive or degenerative anophthalmia—a condition in which an optic vesicle had formed and had subsequently degenerated and completely disappeared—" which links up with the extreme degrees of microphthalmia but microscopically can be distinguished from them " (p. 65). Duke-Elder (1938) designates as anophthalmos " those cases where there is complete failure in the outgrowth of the primary optic vesicle ", as microphthalmos those cases " where the essential nervous structures are present ", and as degenerative or consecutive anophthalmos " those cases which show signs of inflammation at birth, for in these it is possible that inflammatory shrinkage of the globe may have occurred subsequent to its development " (p. 1241).

On the basis of either classification it is likely that there may be at times some difficulty in assigning a particular case to its proper group. For example, how are we to decide whether a case in which we find no neurogenic structures is a " primary " anophthalmia, from failure of the optic outgrowth, or " degenerative ", with disappearance of an optic vesicle which had been formed? Nor is the designation " secondary " very satisfactory for an anophthalmia due to complete suppression of the whole fore-brain, since the genetic inhibition of neuroblastic tissue is primary whether it affects the whole of the fore-brain or only part of it.

We should perhaps base our definitions rather on the structures which are found in each case—distinguishing essential from non-essential parts of the eyeball—and on the interpretation of their

presence from the embryological point of view. It seems to me that the distinction between the two groups of the constituent parts of the developing eye which receive their blood-supply from two separate sources, and the corresponding distinction between two main types of malformation microscopically determined, suggests a different kind of definition less subject to possible misapprehension.

All cases in which the essential parts of the eye, *i.e.*, retina proper and lens, are lacking, whether the mesodermal constituents and the pigment epithelium are present or not, should be called "anophthalmia". The term "microphthalmia" should be reserved for those cases in which all the eye constituents, including retina proper (or optic nerve) and lens, are present either underdeveloped or malformed or only vestigial.

Anophthalmia, thus defined, may be divided into two groups: (1) "Complete anophthalmia", in which no vestiges of the optic outgrowth can be found; in such cases we cannot determine whether the optic vesicle had been formed and suffered complete atrophy or had never been formed at all; (2) "Consecutive anophthalmia", in which an optic vesicle or cup has been certainly formed but has atrophied in the very early stages, leaving, as its vestige, more or less malformed pigment epithelium. Each group may be bilateral or unilateral, and both are almost certainly genetic in origin, the fault being either in the neuroblast itself or in other tissues, *e.g.*, in the haematogenic mesoderm with disturbance of the blood-supply.

Our case belongs to the second type of anophthalmia so defined, and not to the third type of Ida Mann, as according to her definition it would do. It may be added that no case can be diagnosed as anophthalmia on clinical examination alone.

From the purely embryological point of view I would rather exclude a "degenerative" type of anophthalmia, as it presupposes some pathological lesion due to an adverse external influence. No matter whether it occurs during pregnancy or later, degenerative microphthalmia or anophthalmia is the sequel of a pathological process and not a teratological lesion *sensu strictiori*; it may be congenital but not genetic in origin.

Summary

1. A rare case of unilateral anophthalmia is described with details of its microscopical examination.

2. The problem of the apparent independent development, in such cases, of the retina proper and the pigment epithelium—which have a common origin in the optic outgrowth—is discussed,

and the suggestion is made that it is due to a difference in their blood-supply.

3. Definitions of anophthalmia, with two groups, and of microphthalmia are suggested.

I have purposely concentrated the discussion upon anophthalmia. The malformations of the face are less rare and more frequently discussed, and in my opinion they are not directly related to the lesions of the eye itself. The groove that passes from the hare-lip upwards to the left lower eyelid recalls a similar case recorded by Schwalbe (1913, Fig. 123), and the groove across the right cheek from the right angle of the mouth to the right ear is very like one depicted by Keith (1940, Fig. 85).

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A STUDY OF EIGHTY-FOUR CASES OF DELAYED MUSTARD GAS KERATITIS FITTED WITH CONTACT LENSES*

BY

IDA MANN

SINCE 1937, when the condition of delayed mustard gas keratitis was first beginning to be recognised, I have had an opportunity of examining a relatively large number of cases. Of these, 84 have passed through the Contact Lens Clinic at Moorfields in order to be fitted by Dr. Dallos and others. They form the subject of this study and I am deeply indebted to those surgeons† who passed them on to me, for permission to use their cases in this analysis.

Since these form, as far as I know, the only large group of cases of what is obviously a disease process which is new and whose end results and prognosis are not yet fully known, it would seem desirable to make an interim study of them and of the results of treatment to the present time.

The series will give us some information on certain points associated with the wearing of contact lenses, which were up to now not clear. It will provide data on, among others, the following questions:—How long elapsed between the original gassing and the first of the recurrent ulcers? What improvement, if any, in visual acuity was obtained by contact lenses? What was the tolerance of the patients for contact lenses? Did recurrent ulceration continue after wearing contact lenses? Were the patients able to return to work?

The history of the condition when first seen

All the 84 patients gave a history of exposure to mustard gas in 1917 or 1918. They were between the ages of 42 and 63 at the end of 1943. The majority were between 44 and 48 years old and so had been between 19 and 23 years old at the time of the gassing. Slightly more than half the total were gassed in 1917, the rest in 1918.

The diagnosis was made on the history and on the finding of the typical mustard gas scars with corneal degeneration (fat and cholesterin), varicose conjunctival and corneal vessels and avascular scars on the interpalpebral conjunctiva. These changes, first

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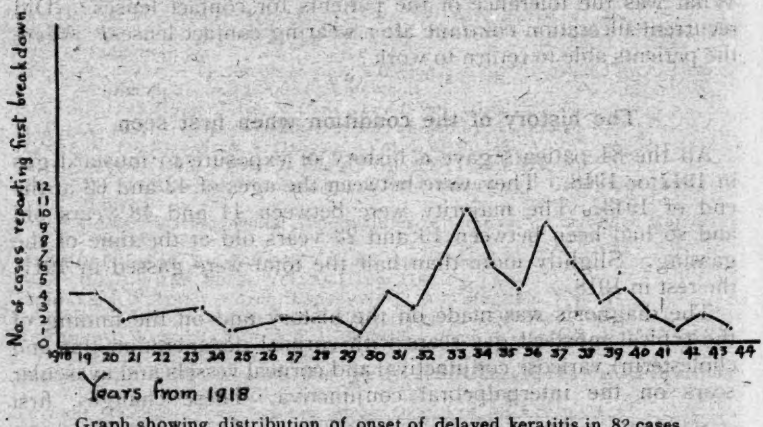
† Messrs. Greeves, Juler, Whiting, Doyne, Davenport, Stallard, Law, King, Lister, Ridley

pointed out by Phillips in 1940 and subsequently confirmed experimentally on rabbits by other workers (Mann and Pullinger, etc.) were present in all the cases. There is no need to describe them here, as they are now well known, though it is possible that cases are still being missed, since they are still appearing and usually do not volunteer the history of gassing unless this is asked for. The patient does not generally connect the delayed keratitis with the exposure to gas. Indeed, of the 84 patients under review, 76 considered that they had recovered completely from the gas. They did not notice anything, except the need for rather frequent changes of glasses in some cases, until the ulceration stage of the delayed keratitis began. This had been treated simply as "recurrent corneal ulcers."

The time of onset of the first ulceration following the initial healing is of interest in bringing out the long quiescent interval. Only eight of the patients stated that the sight of one or both eyes had never been so good as before the gassing and that they had had some sort of eye trouble ever since. Four of these eight have had repeated slight breakdowns ever since 1919. This is, however, exceptional. Usually the only complaint is of altering refraction, this often being characterised by the appearance of and increase in a horizontal plus cylinder, due to slow alteration in curvature of the transverse scar in the cornea. The accompanying graph shows the distribution of the first onset of trouble (delayed keratitis) through the years 1920-1943 of the remaining 76 patients. It will be seen that sporadic cases occurred until 1931



Graph showing distribution of onset of delayed keratitis in 82 cases. Two of the 84 did not remember the date of first onset of trouble after apparent cure. Four stated that they had had continuous trouble from the time of gassing and four had had a slight breakdown within a year.

and that after that date there was a steep rise lasting until 1937, 1933 and 1936 being the peak years.

The recurring ulcers heal but tend to leave facetted scars which gradually diminish visual acuity. The time in hospital immediately after the gas exposure varies from two months to two years in cases with severe chest symptoms as well. The average stay for the group is 6·3 months. No case of delayed keratitis has ever been seen in a patient whose initial ocular symptoms lasted less than eight weeks.

A typical history is that of a man, now aged 45, of whom we possess an almost continuous record. He was gassed in 1918 and was severely ill for two months and convalescent for some time after that. He apparently recovered and returned to his trade of wood turning, which he followed without trouble until 1928. He then sustained a slight injury to the right eye, which produced an ulcer. This history of first onset of ulceration of the unstable scar following a minor injury is common. In some instances it is misleading, as the sensation of a beginning ulcer is very like that of a small foreign body. In this instance it is probably true, since no further trouble occurred in this eye for six years. After the ulcer had healed in 1928 the patient's visual acuity was reduced to 6/12, as a small facetted scar was left. The visual acuity in the left eye was 6/6. This had dropped to 6/9 in 1932 without ulceration, but subsequently improved again slightly to 6/6 in 1934. The right eye began to give serious trouble in 1934 when acuity was reduced by recurrent ulceration to 3/60. This improved to 6/18 the following year, but relapses occurred in 1937 and it fell to 3/60 again. A contact lens was fitted in November, 1937, which improved the eye to 6/12. Ulceration recurred once in 1938, reducing the sight to 6/60 with the contact lens, but this has now improved to 6/18 and no further breakdown has occurred. The left eye had an attack in 1937 and was reduced to 6/9, improved to 6/6 with a contact lens. A severe breakdown occurred in 1939 and vision was temporarily down to 4/60. This eye has also remained well and with a contact lens is 6/6 again. The man wears his contact lenses the whole day and is now perfectly comfortable. The corneae show typical scars and are insensitive. This is almost always the case and in part explains the usual excellent tolerance for contact lenses.

This history with its long interval, its repeated attacks and its fluctuating but slowly deteriorating visual acuity, relieved by wearing contact lenses, is typical of roughly 46 per cent. of the cases. What their subsequent fate will be we do not yet know. That wearing contact lenses does not entirely prevent breakdown and further deterioration of sight seems certain, but it is equally

certain that in a number of cases retention of visual acuity and continuance in work has been made possible for many years (up to seven years, at present). What we do not know is whether earlier fitting would have prevented or retarded breakdown. The relapses mostly began in 1933-6, as we have seen, and our first cases were fitted in 1937.

Improvement in visual acuity from contact lenses

This was present in all but two of the cases. Of these two, one had exceptionally opaque central scars and in the other there was a large hysterical element. In the remainder the improvement was usually dramatic, since the loss of acuity is due more to the unevenness of the corneal surface than to the opacity of the scars. Some typical cases are set down in the table below.

TABLE I.—*Improvement in visual acuity*

Date of first relapse	Present age of patient	Date of contact lens trial	V.A. after spectacle correction		V.A. with contact lenses	
			R	L	R	L
1923	43	1943	fingers at ½ m.	fingers at 1 m.	3/36	6/24
1923	45	1940	6/60	6/60	6/12	6/12
1927	58	1941	Hd. Mvts.	Hd. Mvts.	6/36	6/36
1927	52	1941	6/36	6/6	6/9	6/6
1928	45	1937	3/60	6/9	6/12	6/6
1932	50	1942	<6/60	<6/60	6/36	6/24
1932	46	1941	6/24	6/60	6/12	6/9
1932	50	1939	<6/60	<6/60	6/36	6/24
1933	57	1942	cts. fgs.	cts. fgs.	6/12	3/60
1933	47	1940	<6/60	<6/60	6/18	6/24
1933	47	1939	6/36	6/24	6/12	6/12
1933	47	1938	<6/60	cts. fgs.	6/18	6/24
1934	46	1941	<6/60	<6/60	6/12	6/9
1934	51	1940	6/18	4/60	6/12	6/12
1934	45	1939	2/60	3/60	6/12	6/18
1935	46	1942	6/24	6/60	6/12	6/24
1936	53	1943	<6/60	6/60	6/18	6/9
1936	46	1943	6/9	6/36	6/6	6/9
1938	56	1943	4/60	4/60	6/36	6/24
1939	55	1940	<6/60	cts. fgs.	6/18	6/24

These twenty cases, showing relapses of 5 to 21 years duration, are typical. These twenty (and others) are wearing their contact lenses for 8 to 16 hours a day.

History subsequent to fitting of contact lenses

a. Length of wear. Mustard gas cases usually have very good tolerance for contact lenses, both on account of the relative insensitivity of their corneae and of the very great improvement in visual acuity, which acts as a spur to success in many cases.

The length of wear can be classified into eight hours a day or over (*i.e.*, allowing for a day's work); between five and eight hours; under five hours and not at all. One can also classify according to the number of years the lenses have been in use. The 84 cases (analysed in the following table) demonstrate that in 39 instances the lenses are worn with comfort during the working day. Of these 39, 17 wear them the whole of their waking life, 10 wear them from 10-12 hours a day and the rest for periods varying from 8-10 hours.

Three of the 84 men have died since being fitted. Four had had one eye excised before being fitted. Five men could not wear the lenses at all and eight could not wear them enough to be much good. In 20 cases the details are not complete.

TABLE II.—*Hours per day and years of wear (contact lenses)*

Years in wear	No. of men	Hours of wear per day				
		8–16	5–8	Under 5	Not at all	Not known
<1 year...	7	2	1	1	—	3
1 year ...	6	4	2	—	—	—
2 years ...	12	7	3	1	—	1
3 years ...	10	6	2	2	—	—
4 years ...	15	9	1	1	1	3
5 years ...	13	8	1	—	—	4
6 years ...	4	1	—	—	1	2
7 years ...	6	1	—	1	—	4
not known	11	1	1	2	3	4
1937–1944	84	39	11	8	5	21

A consideration of the occupations of the 39 successful cases shows them to be mostly doing fairly intelligent work. They include a schoolmaster, three clerks, a postmaster, a postman, a telephone operator, a printer, a rating and valuation officer, a motor engineer, a radio engineer, a works foreman, an inspector

in an aircraft factory, two taxi drivers, a railway foreman, a guard, a bus conductor, two restaurant keepers, a motor body builder, a cabinet maker, a wood turner, a carpenter and a bricklayer. Only two are ordinary labourers. Three are looked after by St. Dunstan's and do handicrafts, since even with contact lenses their sight is very variable and they are deteriorating. The majority are well and in work and very satisfied with their lenses.

Of these 39 successful cases, 20 have had one or more relapses since wearing the lenses. Thirteen of these have had far fewer relapses than before wearing the lenses and many have only had one slight one since fitting. Four state that they have had more relapses since wearing contact lenses. In them, and in three others, visual acuity is gradually deteriorating, although they are able to wear their lenses for most of the day.

In Table II it can be seen that five patients were unable to wear their lenses at all. Of these, two were at St. Dunstan's when fitted and got very little improvement in visual acuity. They were working as blind men and had no incentive to persevere. Two others had severe relapses during and after their fittings and are technically blind. One of these two had to have an iridectomy on one eye and a tarsorrhaphy on the other and never managed his lenses at all. The other had a tarsorrhaphy and was sent to St. Dunstan's. The remaining one of the five, who was of independent means, with no need to work, had also frequent relapses.

Eight patients (Table II) wore their lenses less than five hours a day. One of these was the hysteric (mentioned on p. 444), another was neurotic, with frequent relapses, and three saw relatively well with spectacles and preferred to wear them. One has only had his lenses a month and is shaping well. One has relapsed repeatedly and no details are known of the eighth.

b. Relapses. Although relapses do occur in contact lens wearers, they tend to be less frequent, since the glass protects the insensitive cornea from small injuries and any relapses which do occur are due to the continuance of the deep pathological changes in the cornea rather than to surface irritation. Of the 84 cases, 25 had no relapses at all after fitting, 49 had relapses (of these 4 had one only, and 16 slight only, while 19 were of moderate severity and 10 were severe). The history of 10 is uncertain, but they have made no complaint. If severe relapses occur, visual acuity, even with contact lenses, falls in the course of years. We do not know the end result, but Descemetoceles may occur (this does not preclude the wearing of a contact lens), and in very rare cases perforation. There is one small Descemetocele (with visual acuity 6/24), but no perforation, in this series.

Treatment other than contact lenses

In the course of fitting some of these patients, and afterwards, relapses occurred, and various other treatments had to be resorted to. The commonest lesions observed were:

(1) Small shallow ulcers. These heal fairly quickly with mild mydriatics and heat. Hyoscine and diathermy were usually given as a routine, but some of the patients stated that they healed practically as well with hot bathing at home and no drops.

(2) Deeper ulcers, discharging cholesterin and fatty debris from the base. These take longer to heal and may require tarsorrhaphy. They are sometimes hastened by gentle curetting.

(3) Superficial plaques, raised from the surface, of degenerative material. These may mechanically interfere with the wearing of a contact lens and should be scraped off. They are usually easily removed, and much relief is experienced by the patient.

(4) Varicose vessels and blood islands. Sometimes the abnormal vessels at the limbus and just on the cornea become very dilated. The circulation may cease and the distended ends of the vessels may remain like small red blisters. These should be pricked and the blood coaxed out of them. If it is still circulating the feeding vessels should be divided with a fine cautery or a peritomy performed. The relief obtained lasts a long time, though there is a tendency for slow reappearance in adjacent zones.

Summary

Eighty-four cases of delayed mustard gas keratitis are reviewed. They were all fitted with contact lenses, some of them seven years ago. Thirty-nine of the patients wear their lenses from eight to sixteen hours a day, 11 from five to eight hours, eight under five hours, five not at all and in 21 cases the time is not known. The visual acuity in all but two was markedly improved. In twenty-five cases there was no further relapse after fitting, in four cases one relapse only, in 16 very slight relapses and in 10 only were the relapses severe. The age of onset of the symptoms, the occupation of the patients and the treatment of intercurrent complications is discussed.

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A NOTE ON THE ROSETTES, NATURE AND NOMENCLATURE OF "GLIOMA RETINAE"*

BY

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So long ago as 1896 Treacher Collins pointed out the resemblance between the general tumour cells of what is classically known as glioma retinae and foetal retinal cells of the third or fourth month of intra-uterine life.

One of the main points of this paper is an attempt to show, as Mawas has already done, that the columnar cells constituting the rosettes are essentially identical with those of the neuro-epithelium at about this period of gestation. The results here described were obtained with phosphotungstic acid haematoxylin after fixation with Zenker, and differ in important aspects from the classical descriptions of Flexner and Wintersteiner.

On section each rosette consists of a peripheral ring of nuclei situated at the bases of the cells. (Fig. 1.) The columnar cell bodies getting narrower as they pass inwards, point towards the centre of the ring, but usually stop a variable distance from it. Sometimes they do reach the centre and then no central cavity exists.

At or near their apices the cells are joined by dark staining junctional pieces which must surely if we compare them with Fig. 2, represent the external limiting membrane. Sometimes the junctional pieces are themselves joined by thinner lines probably present when the section does not cut the membrane absolutely perpendicularly.

A diplosome, so important in the development of the normal rods and cones and already described by Verhoeff in 1904, can often be made out near the apices of the cells (Figs. 1 and 3), and from this a thread running towards the nucleus of the cell may be present. As in the embryo, the cells may or may not project beyond the external limiting membrane. In the former case a thin process which one thinks represents the outer member of the visual cells may be seen arising from the apex of the cell.

From the general form of the cells (their narrowing towards their apices being only due to their being placed in a circle), the presence of an external limiting membrane, diplosomes, and most probably an outer member, there can be little doubt that the rosettes represent developing rods and cones.

* From the pathological department of the Royal Westminster Ophthalmic Hospital. Received for publication, June 8, 1944.

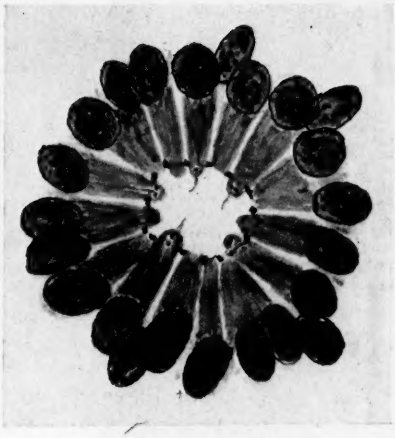

FIG. 1.

Composite figure drawn from a number to show the structure of a rosette.

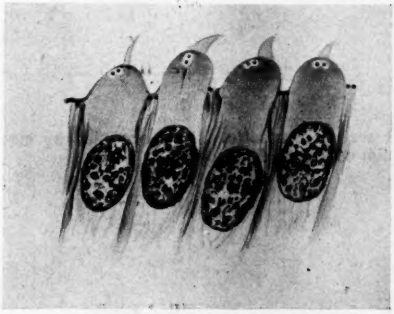

FIG. 2.

Developing cone cells from the paramacular region of a foetus of 345 mm. (From Bach and Seefelder).

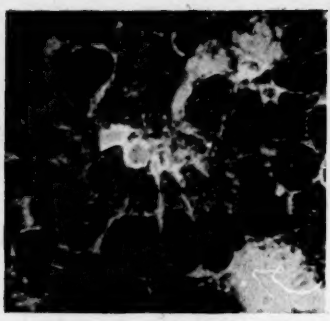

FIG. 3.

Photomicrograph of rosette (untouched). It shows columnar cells narrowing to their apices which project beyond the external limiting membrane and in which diplosomes can be clearly seen. Also pointed processes. × 1000.

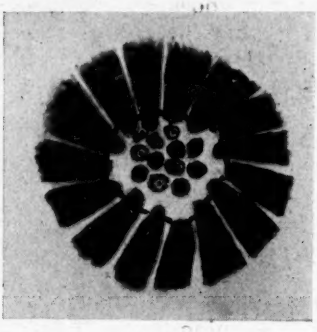

FIG. 4.

The central area of a rosette. It is occupied by circular discs some of which contain a diplosome.

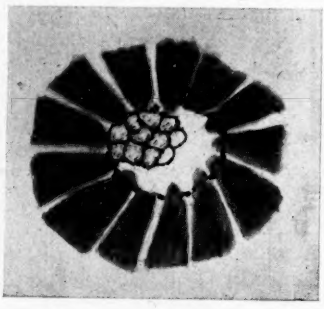

FIG. 5.

The central area here contains a net resembling a flat section of the external limiting membrane.

The contents of the central area of the rosette vary. Often it is partially or mainly filled with circular discs some of which contain a diplosome (Fig. 4). These represent the apices of those cells of the usually more or less spherical rosette at right angles to the plane of section. If we focus up and down on these circular discs we not infrequently see the external limiting membrane in the form of a net (Fig. 5): it is as if we were looking at a flat section of it which we remember has this appearance.

The contents of the central area may degenerate and may then take on many and curious shapes. Some of this degenerate material may be deposited on the external limiting membrane, and may quite easily (for one has done it oneself) be interpreted as representing rudimentary rods and cones. Sometimes the central area may be quite empty.

Now with regard to the nature of "glioma retinae." If we take it as established (and one does not think there can be a great deal of doubt about it) that the rosettes are derived from foetal rod and cone cells, Sattler cannot be right when he holds that even these structures are glial in origin. But that these tumours do contain glial fibres and cells can hardly be doubted. Otherwise we must regard the preparations of Greeff, of Urra and of Ascunce as artefacts, which is hardly likely. Moreover, as is well known the nuclei of the fibres of Müller can, in normal retinae, be quite easily distinguished in sections stained with phosphotungstic acid haematoxylin from the surrounding cells of the inner nuclear layer. They are angular, stain much darker and if cut along their length appear narrow and elongated. Now, angular, or elongated darkly staining nuclei easily distinguished from the surrounding tumour cells, may be seen in sections of glioma retinae coloured by the above stain. One would suggest that these cells, also, are glial in origin.

Next, with regard to the origin of the general tumour cells. It has already been pointed out that these cells are very similar to foetal retinal cells of the third or fourth month of intra-uterine life. Moreover, the nuclei are identical with the nuclei of the rosettes (which probably rules out the possibility of their being glial). Further, it would seem that only rosettes will breed rosettes; for otherwise it would be very difficult to explain why one so often finds them in groups, with extensive areas or whole tumours without them.

Thus we see that, if our argument is correct, the general tumour cells do not arise from cells belonging to the future outer nuclear layer, nor are they glial cells; and it is generally agreed that ganglion cells and mesodermal cells belonging to the retinal blood vessels need not be considered. They must, then, arise from cells destined to form the inner nuclear layer.

We, therefore, come to the conclusion that glioma retinae arises from all the elements of the primitive nuclear zone* excepting probably the ganglion cells, *i.e.*, from embryonic cells destined to form the inner and outer nuclear layers and glia.

To account for differences between one growth of this type and another, why, for instance some tumours consist almost entirely of rosettes while in others none can be found, one would suggest that the relative number of the original constituents may vary.

Finally as to nomenclature. Authors are now almost unanimous in condemning the name glioma retinae. Yet the term is exceedingly useful for, what is very important, everyone, the world over, understands exactly what is meant by it. Also it includes those tumours with, and those tumours without rosettes, so that emphasis can rightly be laid on the spread (common to both types) along dendritically dividing vessels producing the characteristic lobulated structure, and on the characteristic degeneration furthest from the feeding vessel, due to the relatively poor blood-supply, the absence of a capillary net, and the intra-ocular pressure.

Now, a new name must have the advantages of "glioma retinae" without its drawbacks. One thinks that the best term to use is retinoblastoma suggested by Verhoeff in 1924 and adopted by the American Ophthalmological Society in 1926.

It indicates a growth from embryonic retinal cells and is already very widely used. But it must be made synonymous as Verhoeff intended with the classical "glioma retinae." To give a different name to those tumours which contain rosettes, as has been done latterly (Grinker, Duke-Elder), is unnecessary and has led to a great deal of confusion.

* It will be remembered that at an early stage of its development, the retina, before it has been divided by the two molecular layers into three cell layers, consists of a single nuclear zone and the marginal (almost non-nucleated) zone of His.

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VIRUS OPHTHALMIA NEONATORUM

BY

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INTRACELLULAR bodies in the cytoplasm of the conjunctival epithelium were demonstrated by Stargardt in 1909 in a case of bacteriologically negative ophthalmia neonatorum and in some cases of gonococcal ophthalmia. Confirmation of the first finding was soon given by Schmeichler (1909) and of the second by Heymann (1910). These observations created difficult problems. In the first place, they raised the question as to whether ophthalmia neonatorum—which was generally regarded as gonococcal in origin and only occasionally due to other organisms—could occur in a non-organismal form, the exciting agent being the intracellular bodies observed. Secondly, the exact significance of these intracellular bodies required assessment. They had been described in 1907 by Halberstaedter and Prowazek in the conjunctival epithelium of trachoma and had been regarded by them as the causative agent of trachoma. Their occurrence in non-gonococcal and in gonococcal ophthalmia neonatorum was puzzling, and the suggestion emerged that these bodies were a non-specific reaction product to the agent of trachoma and of the gonococcus and possibly other organisms. One view (Herzog, 1910) attempted to unify gonorrhoea and trachoma, trachoma being regarded as gonococcal infection in which the organism had undergone changes adapting it to parasitism on the epithelial cell.

These three conflicting views: (1) that the extracellular bodies were the exciting cause of trachoma, (2) that they were the reaction products of both the exciting agent of trachoma and of gonococcal ophthalmia, and (3) that they were an involutionary form of the gonococcus, found no ready solution. Halberstaedter and Prowazek (1909) were unable to convince themselves of the unity of trachoma and gonorrhoea, for (in contrast to another observer (Jancke, 1910)) they found intracellular bodies in genital gonorrhoea, but also found inclusion bodies in three non-gonococcal cases of ophthalmia neonatorum. This led them to believe that these bodies were independent of gonorrhoeal infection. Their view found support in Lindner's (1909) observation that inclusion bodies could be found in practically all cases of non-gonococcal ophthalmia neonatorum, and but rarely in the gonococcal form. Lindner's clear postulation of a non-organismal form of ophthalmia neonatorum produced by inclusion bodies was

supported by the successful inoculation into monkeys of the vaginal secretion of a mother whose infant had shortly before suffered from inclusion blenorrhoea; in a baboon, the infected conjunctiva showed numerous inclusion bodies. The genital origin of these infecting inclusion bodies was conclusively demonstrated by Halberstaedter and Prowazek (1910) by their finding of such bodies in the genital epithelium of a mother whose infant was suffering from inclusion blenorrhoea.

Lindner's postulation of a genital infection due to inclusion bodies and producing in the infant a non-bacterial ophthalmia neonatorum and in animals an affection clinically and histologically similar to trachoma, inevitably raised the question of the relationship between inclusion blenorrhoea and trachoma. Lindner's own view is summarised by his name of Paratrachoma for inclusion blenorrhoea.

Following the brilliant and intensive pioneer investigations of around 1909-1911 but little progress was made until recent years, when the whole field of virus study has been enormously enriched. It is now possible to speak confidently of a neonatal form of inclusion conjunctivitis and to indicate some of its essential features.

1. *Incidence.*—In a series of 261 cases of ophthalmia neonatorum (in 87 per cent. of which the causal factor could be determined) Thygeson (1936) had 23 cases (=8·8 per cent.) of inclusion blenorrhoea. This ranked third in order frequency, staphylococcus coming first with 51·7 per cent. and pneumococcus second with 13·0 per cent. (The gonococcus came lowest with one case (0·38 per cent.)—a tribute to the efficacy of silver nitrate prophylaxis at the Dept. of Obstetrics of the University of Iowa Hospital.) In relation to the number of births (3,939) these 23 cases constituted an incidence of 0·8 per cent. In a second series of 7,209 births at the Sloane Hospital for Women in New York there were 25 cases of inclusion conjunctivitis, making an incidence of 0·34 per hundred births (Thygeson and Stone, 1942). On statistics from the same hospital, Flack (1942) gives 94 cases of ophthalmia neonatorum in 6,289 births (=1·49 per cent.); inclusion blenorrhoea was responsible for 32 instances, giving 34·0 per cent. of all ophthalmia and an incidence of 0·51 per 100 births. James (1930) observed 4 cases in 2,446 deliveries, giving an incidence of 0·16 per hundred births, whilst Braley (1942) observed 16 cases in 495 deliveries, an incidence of 3·2 per cent. In Montreal, McKee (1942) found inclusion bodies in 42 out of 62 consecutive cases of ophthalmia neonatorum; in 25 of these, epithelial cell inclusions alone were present, in 15 in combination with gonococci, and in single cases the associated organism was the pneumococcus and streptococcus respectively.

2. *Mode of Infection.*—Subsequent to the demonstration by Halberstaedter and Prowazek (1910) of inclusion bodies in the genital epithelium of the mother of an infected baby, Lindner (1910) found inclusion bodies and free initial bodies in three instances of non-gonorrhoeal urethritis in men. Lindner, Fritsch and Hofstaetter (1910) and also Heymann (1910) succeeded in inducing a trachoma-like reaction in monkeys by inoculation with the infectious agent isolated from such urethritis, the eyes of affected infants and from the genital passages of their mothers. Thygeson (1934) found inclusion bodies in the vaginae of four mothers of affected infants, and in three of these the infectivity of the vaginal secretion was proved by the positive inoculation of the conjunctivae of the sphinx baboon. Thygeson and Mengert (1936) stressed the localization of inclusion bodies at the cervix, whilst Braley (1938) limited the zone to the transitional epithelium near the external os of the cervix where the columnar epithelium of the endocervix changes into the stratified squamous epithelium of the exocervix and vagina. In 1942 Thygeson and Stone found that cervical scrapings in 13 mothers of infected infants gave positive results 7 times microscopically and 10 times in inoculation experiments in the baboon. Seven of the 12 fathers who were interviewed told of having had a " urethritis of some sort " at some time of their lives and most admitted sexual promiscuity.

3. *Incubation Period.*—Thygeson studied in detail 11 cases in 1934, and supplemented these by 8 cases in 1936 (Thygeson and Mengert) and 38 in 1942 (Thygeson and Stone, 1942[a]). In a few cases the apparent onset of the affection was delayed beyond the tenth day, but generally occurred within 7 to 8 days; in no case had it come on before the 5th day. Three cases of accidental infection in obstetricians (Thygeson and Mengert, 1936; Thygeson and Stone, 1942) occurred 8 days, 7 days and (?) 7 days respectively.

4. *Clinical Features.*—Like most other forms of ophthalmia neonatorum inclusion blenorrhoea may vary considerably in severity. The untreated case is generally acute for 7 to 10 days, and may take three months or longer to subside. Thygeson speaks of " 3 to 14 months of chronicity with gradual diminution of the inflammation and secretion." Residual changes have not been observed. Thygeson (1936) holds that inclusion blenorrhoea can be distinguished clinically from other forms of ophthalmia neonatorum by the predominant involvement of the lower fornix and the presence of marked papillary hypertrophy (apart from the difference in incubation period). Elsewhere he does not consider that an accurate diagnosis can be made on the clinical signs alone (Thygeson and Mengert, 1936). Though the affection may be

one-sided to begin with, the second eye generally becomes involved. Pseudomembranes in the acute stage and scar-formation from the severity of the inflammation have been observed (Aust, 1933; Lumbroso, 1933 and 1934).

5. *The Nature of the Infecting Agent.*—Early attempts at filtering the virus were largely unsuccessful owing to the absorptive surfaces of the pores. The more recent filters of graded collodion membranes (grodocol filters) have enabled an estimate of the particle size as lying between 0·39 and 0·15 micron. Direct microscopic measurement of the elementary body shows it to be from 0·2 to 0·25 micron in diameter, whilst the initial body is 1 micron or more.

The virus is morphologically indistinguishable from the trachoma virus with its cycle of free elementary bodies entering the cytoplasm of an epithelial cell, swelling to an initial body, dividing to form initial bodies of large size and further subdividing to form smaller elementary bodies, which grow to occupy much of the cytoplasm and ultimately burst the cytoplasm to escape as free initial bodies in the surrounding secretion. Attempts to cultivate the initial bodies have so far failed. These aspects are fully discussed by Braley (1938, 1939 and 1940), Thygeson and Stone (1942), Thygeson (1943) and by van Rooyen and Rhodes (1940).

6. *Response to Treatment.*—In contrast to trachoma, in which opinions on the value of the sulphonamides are conflicting, there is general agreement that inclusion blenorrhoea responds quickly to this mode of treatment. (Allen, 1937; Thygeson, 1939 and 1941; Giddens and Howard, 1940; Lugossy, 1940; McKee, 1942; Braley, 1942.) According to Thygeson and Stone (1942)[b], sulphathiazole ointment locally is almost as satisfactory as oral administration.

7. *Incidence of the Genito-Urinary Virus Infection Responsible for Inclusion Blenorrhoea.*—In 131 non-pregnant women suffering from various gynaecological conditions other than gonococcal, the virus could be demonstrated five times either by microscopic examination or baboon inoculation, giving an incidence of 3·8 per cent. In 53 patients with gonococcal cervicitis (none of whom showed urethritis), inclusion bodies were seen 5 times, and baboon inoculation was successful in 3 of the 4 experiments carried out. In 100 men with acute anterior urethritis, the virus of inclusion conjunctivitis was demonstrated 8 times by baboon inoculation; in 6 out of these 8 cases gonorrhoea was also present (Thygeson and Stone, 1942[a]).

Experience at White Oak Hospital

During the period January 1, 1942, to December 31, 1943, 269 cases of ophthalmia neonatorum have been treated at White Oak

Hospital. A full account of these cases appears elsewhere (Sorsby and Hoffa, 1944); the present record concerns the 28 cases of inclusion blenorrhoea in this series. They constitute 10·4 per cent. of the total.

1. *Diagnosis.*—The diagnosis was made on the finding of inclusion bodies in scrapings taken from the conjunctiva (Figs. 2, 3 and 5).

Technique.—(1) Irrigation to wash away all pus and muco-pus. (2) Instillation of gutt. adrenalin 1:1,000 to avoid excessive bleeding. (3) Scraping with a sharp chalazion spoon or scalpel to obtain a thin shaving of conjunctival epithelium, as free as possible from blood and discharge. (4) Transfer of two or three of such scrapings on to a slide. (5) Teasing of this material into as thin layers as possible. (6) Drying for 30 seconds over a spirit lamp flame. (7) Dipping in methyl alcohol (A.R.) for 30 minutes. (8) Giesma staining 20 for 24 hours. To be satisfactory, sections should be thin enough to contain one layer of cells only.

2. *Bacteriology.*—One of the 28 cases could hardly be designated as ophthalmia neonatorum, as the ophthalmia occurred in a boy aged 2 years. The smear and culture in this case showed abundance of staphylococcus aureus. In the remaining 27 cases no organisms were present either in the smear or culture in 24 cases, whilst in one of the residual 3 cases the staphylococci and diphtheroids present were scanty and regarded as of no pathogenic significance.

3. *Clinical features.*

a. Onset.—The following table shows the day of onset after birth in 27 cases arranged in two groups: 25 cases with inclusion bodies only and the 2 cases showing associated organisms:—

Onset on	Inclusion bodies	Inclusion bodies and organisms
2nd day	1	—
3rd day	2	—
4th day	1	1 (Koch-Weeks)
5th day	1	—
6th day	3	—
7th day	4	—
8th day	3	1 (Haemolytic streptococci)
9th day	2	—
10th day	2	—
11th day	1	—
12th day	4	—
20th day	1	—
	25	2

It will be seen that of the 25 uncomplicated cases showing inclusion bodies, in 20 the onset occurred on or after the 6th day of life.

b. Severity.—The condition was bilateral in 16 cases, and unilateral in 11. Discharge was slight in 3 cases, moderate in 18 and profuse in 6; muco-pus only was present in 14 cases, the other 13 showing pus. Marked oedema of the lids was noted 6 times. The corneae were clear in all cases but one, in which they were hazy on admission.

c. Course.—Neither on admission nor during the course of treatment did these 27 cases show any features distinguishing them from other cases of ophthalmia neonatorum.

d. Treatment.—One case was treated with penicillin locally and will be discussed in a subsequent publication on penicillin in ophthalmia neonatorum. The remaining 27 cases received sulphonamides by mouth; 6 showed clinical cure within 1-3 days; 18 required 4-8 days, and the remaining 3 from 9-30 days. These results are parallel to those obtained in ophthalmia neonatorum of bacterial origin (Sorsby and Hoffa, 1944). The sulphonamide used was: sulphapyridine in 10 cases, sulphathiazole in 6, sulphamezathine in 5, sulphadiazine in 3, and in 2 cases two or more preparations were used. No obvious difference in response to the different sulphonamides could be established in this small series.

4. *Genital origin of the affection.*—In 25 instances the mothers were admitted with the babies. Gonorrhoea was not present in any of them, and in 5 instances inclusion bodies were found in the scrapings from the cervical epithelium (Figs. 1 and 4), carried out as a special measure in these 25 cases. These 5 cases showed the following features of interest:

(i) History of leucorrhoea during pregnancy: 3 times. The discharge was slight in 2 mothers and more severe in 1.

(ii) Cervical and urethral smears. Smears: No organisms found, 1 case. Gram positive cocci, 3 cases. Gram positive Doederlein bac., 1 case.

Cultures: Staphylococci, 1 case; staphylococcus albus, 1 case; staphylococci and diphtheroids, 1 case; diphtheroids only, 1 case; bac. coliform and diphtheroids, 1 case.

(iii) Local condition. Old cervicitis with adhesions was noted in one case, and slight persistent discharge in 2 more (Miss G. Sands' report).

Technique for cervical scraping to demonstrate inclusion bodies.—Essentially the procedure is the same as for taking scrapings from the conjunctiva with the appropriate modifications of technique. The scraping should be taken from the transitional epithelium at the orifice of the cervix. There is considerable difficulty in getting clean and sufficiently thin scrapings owing to

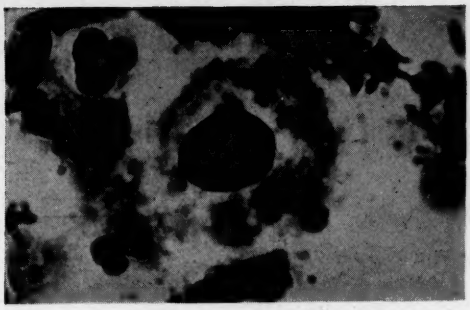

FIG. 1.

Mrs. E. B.—Cervical scraping showing initial body in cytoplasm of epithelial cell.

FIG. 2.

Infant B.—Scraping from conjunctiva (of infant of Mrs. E. B) showing elementary bodies.

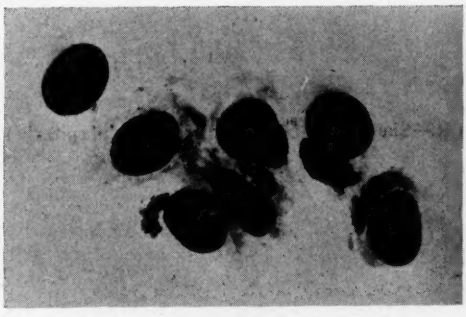

FIG. 3.

Infant K.—Scraping from conjunctiva showing elementary bodies in cytoplasm of epithelial cell.

FIG. 4.

Mrs. H.—Cervical scraping showing elementary bodies in cytoplasm of epithelial cell.

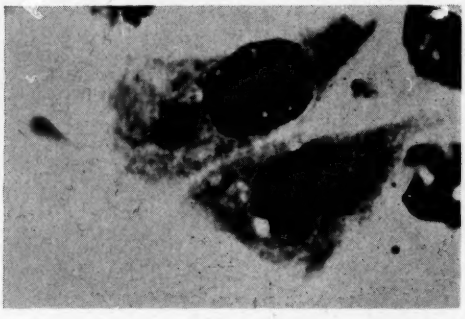

FIG. 5.

Infant R.—Showing initial body in cytoplasm of epithelial cell.

the softness of the cervix in the post-partum period and the tendency to bleeding and discharge.

5. *Validity of these findings.*—The presence of inclusion bodies in conjunctival and cervical scrapings does not, of course, establish the virus origin of the ophthalmia in these 27 cases. It has to be proved that these inclusions are pathogenic, and only inoculations in the baboon (or in human volunteers) could establish this. Such inoculations were not carried out and the validity of these findings is assumed on the basis that the inclusions are morphologically of the same type (extra nuclear; cytoplasmic) as that recorded by other observers. In one case the mother's serum was subjected to a complement fixation test with a psittacosis antigen with a negative result (Prof. S. P. Bedson).

Summary

1. An account is given of the inclusion type of ophthalmia neonatorum.

2. From a study of 27 cases observed in a series of 269 consecutive cases of ophthalmia neonatorum at White Oak Hospital it is concluded that, apart from a later onset in most but by no means all cases, inclusion blenorrhoea has no distinguishing features from micróbial ophthalmia neonatorum, either in course or in response to sulphonamide therapy.

3. In 5 out of 25 mothers of infants with inclusion blenorrhoea cervical scrapings showed inclusion bodies.

We are indebted to Dr. G. Heisler, the Matron and Sister Condon of White Oak Hospital for their willing help.

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INCOMPLETE AVULSION OF THE EYE—REPORT OF A CASE*

BY

Major I. C. MICHAELSON, R.A.M.C.

OPHTHALMIC SPECIALIST

THIS case is of interest because it shows how much functional recovery can follow severe damage to the ocular tissues.

In a port in the Middle East on September 6, 1942, Fireman T.C., aged 29 years, of the Merchant Navy, was assaulted by a soldier who attempted to gouge out his right eye with a spike-ring.

On the following day he was admitted to a (Scottish) General Hospital, where he was examined by Capt. J. Howat, R.A.M.C., graded ophthalmologist, and myself. His condition was as follows:—

1. A continuous clean-cut oval incised wound through the upper and lower lids including their conjunctiva separated them from the orbit through most of their extent, and caused them to be flapped outwards on a temporal base. The cut did not pass right into the inner canthus, but transversed the upper and lower lid margins about the junction of the outer three-quarters and inner quarter.

2. The globe was extremely proptosed between the surrounding oedematous tissues, and could not be replaced. All four recti muscles were completely severed from their global attachments at distances varying from 2-6 mm. (approximately). The conjunctiva showed a circular wound roughly concentric with the limbus.

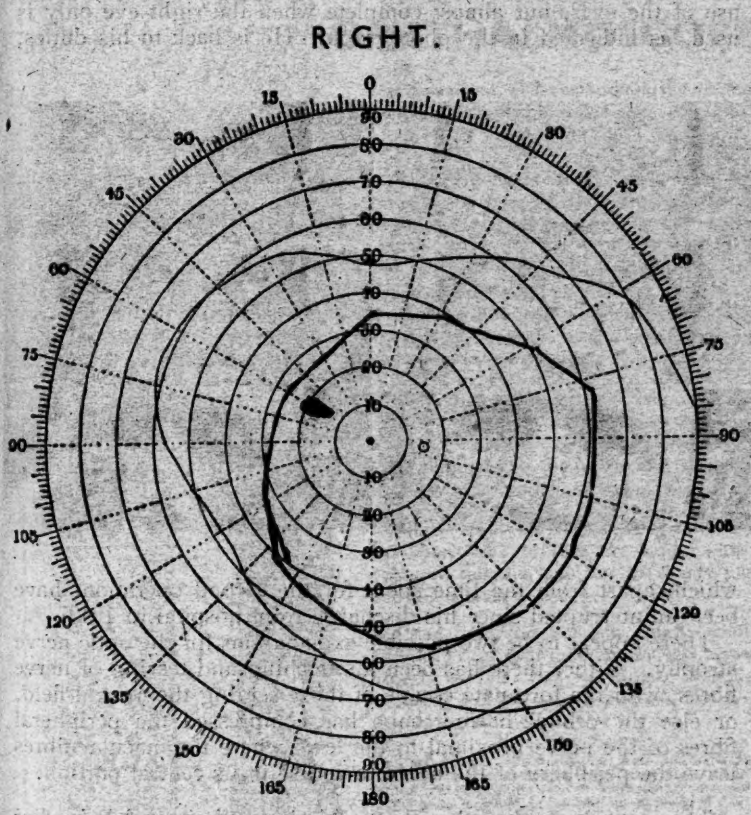
3. The vitreous showed a very extensive haemorrhage which together with the corneal haze prevented a view of the fundus. The visual acuity was perception of hand movements.

Under a general anaesthetic operation was performed on the day of admission. With difficulty the recti muscles were sought for in the orbit. They were stitched to their insertions; it was hoped to their respective insertions, as orientation presented difficulties. Only during the convalescence was there a reassurance that the internal and inferior recti had not been made to change places. The conjunctival wound was closed (no fresh incision had been necessary), and the lids brought back to their positions.

Convalescence was uneventful, and after seven weeks the patient was discharged to his ship. The condition was satisfactory, vision was 6/24, and the vitreous had greatly cleared, but not sufficiently

* Received for publication, April 17, 1944.

to permit a good view of the fundus. Through unavoidable circumstances the patient was lost sight of until January 24, 1944, when he again came under observation, still in the Middle East, but in a different country. He complained of some diplopia when looking forward and to the left. The right eye showed a slight



divergence with some limitation in adduction. Otherwise the ocular movements were good. The right eye showed a pronounced optic atrophy with an otherwise normal fundus. The media were clear. The visual acuity of the right eye was 6/9. The field showed some concentric contraction (see chart) and a small paracentral scotoma, but even so the visual loss was not in keeping with the marked pallor of the disc.

On January 27, 1944, the right external rectus muscle was lengthened.

This present condition is indicated in the accompanying photographs. There is no diplopia on looking forwards, but some on looking far to the left. The movements are all good except adduction of the right eye, which is still somewhat limited on binocular use of the eyes, but almost complete when the right eye only is used, as indicated in the photograph. He is back to his duties,

which, apart from the time spent for the second operation, have been uninterrupted since his discharge from hospital in 1942.

There appear to be two possible explanations for the optic nerve atrophy. Either there has been a stretching and tearing of nerve fibres, with the fortunate escape of those serving the central field, or else the orbital haemorrhage has compressed the peripheral fibres of the nerve proximal to the level where the macular fibres leave the periphery of the nerve to course in its central portion.

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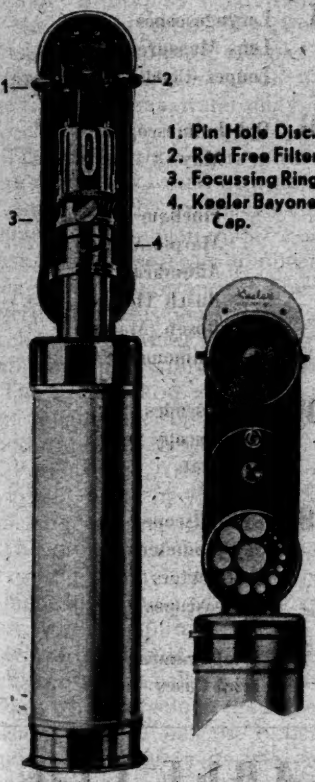

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A GAS MASK WAFER FOR PRESBYOPIA*

BY

Major W. O. G. TAYLOR, R.A.M.C.

WHEN officers over forty are required to wear a respirator they frequently feel the need for some device to assist near vision which will yet not interfere with the vision for distance.

It is manifestly impossible to adjust reading glasses whenever they may be needed in the middle of a gas attack, and some method to overcome this difficulty had to be devised. There are four possible solutions: (1) A pair of respirator lenses may be made of the bifocal type. (2) A lens may be held either inside or outside the respirator eye-piece by mechanical means. (3) A lens surface may be worked on the glass of the respirator eye-piece itself. (4) A lens wafer may be cemented to the respirator eye-piece.

The first method is unsuitable because in many cases the bifocal part of the lens would be hidden by the nose-piece of the respirator. It would also be expensive and troublesome to make, and would require the application of "anti-dim" before adjustment of the mask. In large scale application expense and man-hours are of very great importance. The second method has already been described in this journal (1941); it is open to the difficulties of a mechanical method and is troublesome to anti-dim. The third method is impossibly expensive and raises difficulties in supply.

The last method was developed at a Military Hospital in Scotland during the summer of 1941. For security reasons this work could not be disclosed before. The honour chiefly belongs to Sgt. R. Freeman, R.A.M.C., sergeant optician to the eye centre at that hospital, and to Messrs. Scott and Madill, manufacturing opticians, who co-operated whole-heartedly.

The problem to be overcome was the method of fixation of the correcting wafer. It will be remembered that the respirator lens is made of laminated safety glass, and hence if heat is applied there will be splitting of the laminations. Yet to fix glass to glass with Canada Balsam requires the application of heat in the process of "baking." Other adhesives have optical and other defects which preclude their use. A substance known as "British Balsam" which has the optical qualities of Canada Balsam but requires less heat in its use was brought to our attention by the manufacturing opticians, and it was found that by careful preheating and slow cooling the wafer could be affixed without separation of the laminae. It is probable that success lies in the care

* Received for publication, June 7, 1944.

with which this is carried out, since, as can be seen in the photograph of the device in use, three years have not shown any deterioration in the wafers or the adhesive. Whereas, although the device has been officially adopted, it is understood that the adhesive has not proved entirely satisfactory in general use.

Optical Problems Involved

The method of determining the required reading addition is best solved by trial and error in view of the great variation in axial distance of the eye-piece from the eye in different individuals. The trial lenses are held against the outside of the eye-piece until the most suitable is found. If a distance correction is also required, the Mk. III respirator spectacles are worn inside the gas mask. For the purposes of reading in the relatively short periods during which a respirator must be worn, it is sufficient to use one eye alone. In fact, the width of the nose-piece is such that binocular vision is hardly possible at reading distance (depending on the exact relationship between p.d. and facial width). Thus the wafer is fixed to one eye-piece only. Normally the left is chosen to leave the right entirely free for shooting, unless the wafer is needed to see the foresight—a complicated manoeuvre! The size of the reading wafer need be no more than 12×20 mm., which gives a field of about 48×80 mm. at comfortable reading distance. Most of the field of the respirator eye-piece is therefore still available for distance vision and the part within the wafer area is still covered by the right eye working monocularly. It is arranged that the wafer is attached below the line of vision with the head in the normal attitude so that binocular vision is still present in the most essential part of the field.

The weight of the addition is negligible, and since it is affixed to the outside of the respirator, no problem arises from dimming due to the condensation of the breath. If it is necessary to alter the lens, or if a respirator has been heavily contaminated, the wafer can be readily removed. The cost is low (two or three shillings) and no hesitation need be felt in its discard.

Use in Ametropia

The wafer can be used in ametropia, and has certain advantages over the ordinary Mk. III glasses, such as, that it is always available when the respirator is adjusted. As an experiment the author's own respirator was so fitted, and the photograph shows it in use. The refraction was: Rt.—2·50 D.Sph. - 1·75 D.Cyl. 110°, 6/5. L.—2·50 D.Sph. - 1·75 D.Cyl. 85°, 6/5.

The use of cylinders would, however, introduce many difficulties

in testing and fitting, as well as greatly increasing the cost. Both spherical and cylindrical corrections would have to be ground on the same surface if the wafer was to be applied to the flat surface of the eye-piece. The inclination of the eye-pieces also contributed a variable and difficult factor to calculate. If spherical lenses are rotated round an axis at right angles to the visual axis,

Photograph showing respirator with special large wafers for correction of ametropia.

then an astigmatic effect is produced, corresponding to the introduction of a cylindrical lens whose axis coincides with the axis of rotation. In the case under consideration it will be noted that the refraction shows a cylindrical error which is approximately vertical and of the same sign as the spherical element. Since the respirator eye-pieces make an angle with each other of between 15°-30° on a vertical axis, it will be seen that minus spheres lying flat on the eye-pieces will actually have a partial cylindrical effect of minus sign and axis 90° in straightforward gaze. This had the effect

of enhancing the visual acuity even without separate correction of the astigmatism. The V.A. was R. 6/18, L. 6/18, together 6/12, wearing −3·00 D.Sph. R. and L.

Had the astigmatism required a cylinder of similar sign to the sphere, at a horizontal axis, it would, of course, have been artificially exaggerated. The problem does not arise in the wafer for reading only, since only one eye is in use and the visual axis can be normal to the surface of the wafer.

Field of vision while using the wafer for ametropia

The object in the correction of ametropia by this method is to secure as large a field of vision as possible, consistent with lightness, simplicity, and cheapness. Accordingly a larger wafer than is used for reading only was applied to each eye-piece. They measured 25 × 30 mm. and were so placed as to occupy as much as possible of the available binocular field. The fields of fixation were measured on a recording perimeter and were found to extend 38 deg. on each side of the fixation point, 20 deg. above, and 30 deg. below it while looking through the wafers.

This is illustrated in diagram III. For comparison, the field of fixation through the respirator eye-pieces alone is also shown, diagram I, and also the field through Mk. III respirator glasses

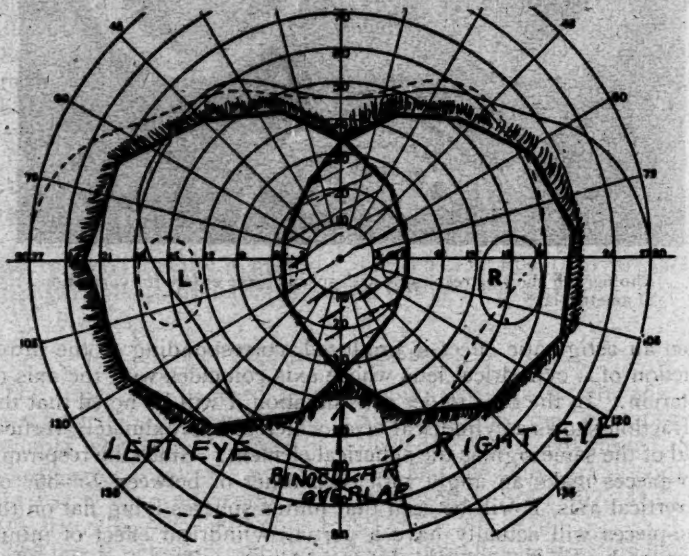


DIAGRAM I.

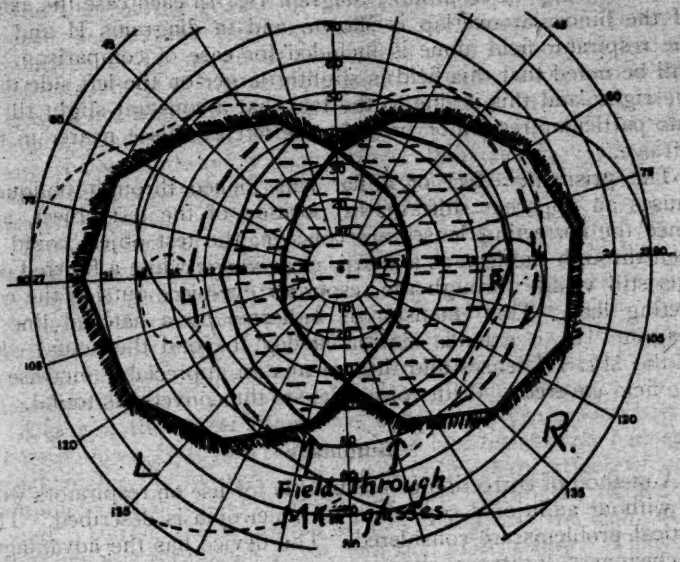


DIAGRAM II.

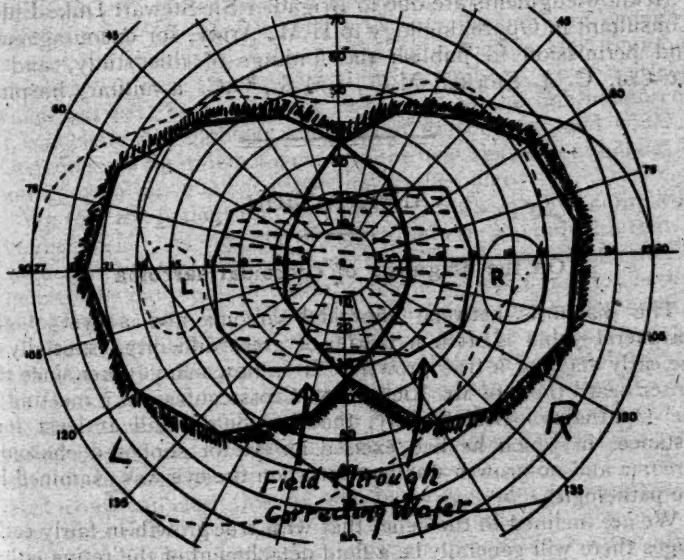


DIAGRAM III.

while wearing the respirator, diagram II. In each case the extent of the binocular overlap is shown, and in diagrams II and III the respirator field alone is included for ease of comparison. It will be noted that this field is slightly larger on the left side than the right, and this is due to the fact that a constant slight tilt of this particular respirator brought the left eye-piece nearer to the left eye.

The prismatic effect of a flat lens looked through obliquely causes an apparent shift in the position of the test object, and since the correcting lenses are concave, the test object could be seen through the lens as a sharp, clear image while a blurred one was still visible through the respirator eye-piece outside the correcting lens. This extension is indicated by a hatched line in diagram II: it extends almost 50 deg. beyond the actual edge of the Mk. III lenses and thus means an appreciable increase in the field covered. With convex lenses the converse is found.

Summary

A method of correction of presbyopia for use on respirators with or without additional correction for ametropia is described. The optical problems are considered. The device has the advantages of cheapness, lightness, absence of mechanical parts, freedom from dimming, and ease of testing and fitting.

Acknowledgments are due to Brigadier Sir Stewart Duke-Elder, Consultant in Ophthalmology to H.M. Army, for encouragement and permission to publish the findings of this study, and to Lt.-Col. C. J. Stocker, M.C., I.M.S., O.C. a military hospital.

ANNOTATION

On the diagnosis of choroidal sarcoma

The diagnosis between choroidal sarcoma and a cyst of the peripheral retina is often a matter of great difficulty, especially in the early stage of a true growth. It is now many years since the writer heard the late Mr. Richardson Cross confess, at a meeting of the Ophthalmological Society, that he could recall at least four instances in which he had excised an eye for supposed choroidal sarcoma and no growth was present when the eye was examined by the pathologist.

We are inclined to the belief that with true growth in fairly early stages there will generally be a fluid detachment of the retina either

at the edge of the growth or in the most dependent part of the eyeball besides the bulge caused by the neoplasm. In cystic conditions, so far as we are aware, it is most unusual to find any fluid detachment of the retina present, though disinsertion in later stages is not uncommon. Another point which is of help is the amount of visual field reduction present. In choroidal sarcoma there is nearly always a biggish defect whereas in cysts of the retina there is usually no sector-shaped defect and if any contraction be present it is general and very slight.

The question of transillumination is also important. If, on transillumination, an obvious shadow is found it is more likely to be due to a growth than to a cyst. But we have seen cases where the results of transillumination have been anomalous and we should be inclined, in trying to make a diagnosis, to pin our faith to the amount of field limitation present and the presence of a fluid detachment as well as the more obvious globular bulge.

A case of the writer's some five and twenty years ago bears on these points. Here was a man in the late fifties who had spent much of his life abroad. He had a fairly sharp attack of acute conjunctivitis in each eye which his own doctor had treated and cured. During the treatment he had found that the sight of his right eye was very much worse than that of its fellow. There was also a history of syphilis as a young man.

We found vision in the right eye to be only about 6/36 against 6/9 in the left. After the pupil was dilated some pigmentary patches were found at the macula which, in our opinion, were enough to account for the visual failure. Taking a routine look round the periphery we were amazed to find in the temporal sector a swelling which was best seen with +12·0 D. lens in the ophthalmoscope. It was dark and globular and looked as solid as solid could be. There was no fluid detachment and the field showed only about 10° limitation in the area corresponding to the bulge.

We told the patient that this swelling in the eye had complicated the diagnosis. As regards the visual failure we thought that the patches of pigment were obviously the cause of this, and we ascribed them to the old syphilitic lesion. The bulge was a question between new growth and cyst. We rather thought the former, and he would be wise to get further advice. We gave him the names of two men with international reputations, one of whom was quite certain that the condition was a growth; the other said that he was not sure of the transillumination, but had no doubt that the eye was one that should be removed. Besides these two opinions the patient took a third on his own account. This amounted to the fact that his eye must come out and that he was lucky in that the condition had been discovered in a comparatively early stage. The eye was removed and pathological examination proved that after all the condition was cystic.

THE INSTITUTE OF OPHTHALMOLOGY FOR RESEARCH AND TEACHING

THE immense clinical material and the considerable research activities at the Royal Eye Hospital have prompted the Council of the Hospital to initiate the establishment of an Institute of Ophthalmology where teaching and research can be carried out systematically and co-ordinated with the work of laboratories and of other ophthalmic and of general hospitals.

The Institute with an independent Board of Governors will function under the patronage of the Archbishop of Canterbury, the Archbishop of Westminster, the Very Rev. Cyril Golding-Bird, Bishop of Guildford, General Sir Bernard Montgomery, K.C.B., and Sir Philip Henriques, K.B.E., and under the Presidency of Admiral Sir Edward Evans, K.C.B. A Board of Governors is being constituted with Mr. James Cadman as Treasurer and Chairman of the Finance Committee.

To ensure that the Institute is broadly based, panels of advisors have been set up to help in the planning and carrying out of the work. The following have agreed to act as Scientific Advisors:—

Professor E. D. Adrian, O.M., F.R.S.; Professor E. C. Dodds, F.R.S.; Professor Sir Alexander Fleming, F.R.S.; Professor Major Greenwood, F.R.S.; Professor I. M. Heilbron, F.R.S.; Professor E. L. Kennaway, F.R.S.; Professor Thomas Nicol, F.R.S.E.; Thomas Smith, Esq., F.R.S.; Professor Samson Wright, F.R.C.P.

The panel of Medical and Surgical Advisors as at present constituted consists of:—

Mr. Harold Burrows; Mr. J. B. Hunter; Dr. R. D. Lawrence; Mr. V. E. Negus; Professor S. Nevin; Rear Admiral C. P. G. Wakeley; Dr. P. J. Watkin.

The Ophthalmic Advisors are:—

George Black, Esq.; M. Dykes Bower, Esq.; Miss J. M. Dollar; P. G. Doyne, Esq.; P. Jameson Evans, Esq.; N. P. R. Galloway, Esq.; A. J. B. Goldsmith, Esq.; Basil Graves, Esq.; P. M. Moffatt, Esq.; A. Nutt, Esq.; G. G. Penman, Esq.; Frederick Ridley, Esq.; B. W. Rycroft, Esq.; L. H. Savin, Esq.; C. G. Kay Sharp, Esq.; Arnold Sorsby, Esq.; H. J. Taggart, Esq.; T. M. Tyrrell, Esq.; T. H. Whittington, Esq.

The amenities of the Institute will be open to all ophthalmologists and offers of co-operation will be welcomed.

ABSTRACTS

I.—MEDICAL OPHTHALMOLOGY

(1) **Cordes, F. C. and Dickson, O. C. (San Francisco).—Angiomatosis retinae (von Hippel's disease). Results following irradiation of three eyes.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 454, 1943.

(1) **Cordes** and **Dickson** review the history of angiomatosis retinae (von Hippel—Lindau's disease), its physical signs, the incidence of associated central nervous system lesions, its prognosis and treatment. It is evident that in the late stages of the disease in the eye, all known forms of treatment to date are of no value. The literature is reviewed about cases treated by electrolysis, diathermy, radium and X-rays.

The authors describe two patients, in one X-ray treatment was administered to one eye and in the other to both eyes. In the latter case one eye was severely affected, and irradiation did little or nothing in its progress to blindness from increasing gliosis and detachment. In the other eye of this case and one eye of the first case the authors suggest that on ophthalmoscopic examination, the changes in the intra-ocular neoplasm and its feeding vessels were towards a regression. In the former case a dose of 1,202 r was given, and in the latter 1,800 r were administered to each eye.

The authors comment that up-to-date treatment by electrolysis, diathermy and irradiation is of value only in the early stages of the disease.

H. B. STALLARD.

(2) **Lloyd, R. I. (Brooklyn, New York).—The hereditary macular degenerations.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 499, 1943.

(2) **Lloyd** comments that the characteristics of the hereditary monocular degenerations are *familial incidence; bilaterality; onset* at epochs such as birth, second dentition, puberty, the end of skeletal growth, beginning of involution and senility; and the time and manner of onset is the same for members of a family. He states that if the transmitter is a female, she is usually affected, but the male transmitter may escape.

The author discusses the ophthalmoscopic picture of hereditary macular degeneration in four groups. His paper is well illustrated with fundus drawings and micro-photographs of morbid histology.

H. B. STALLARD.

II.—MISCELLANEOUS

(1) **Williamson-Noble, F. A. (London).—Contact lenses.** *The Practitioner*, p. 82, February, 1944.

(1) The prototype of the modern contact lens was made by Thomas Young at the end of the eighteenth century, a man whose genius equalled that of Isaac Newton. **Williamson-Noble** describes how contact lenses are now made and fitted to the wearer. From the optical standpoint they have several advantages over ordinary spectacles, they move about with the eye, they are closer to the eyeball, they afford protection to the eye and are almost impossible to break when *in situ*, they are prevented from fogging by movements of the lids, they are invisible and they cannot be knocked off. They are especially useful in high myopia, conical cornea, corneal scarring and old mustard-gas burns. Certain disadvantages attaching to their use are described.

A. F. MACCALLAN.

(2) **Nicholls, John V. V. (Ottawa).—Ophthalmology in the R.C.A.F.** *Can. Med. Assoc. Jl.*, April, 1944.

(2) **Wing-Commander Nicholls** contributes a short paper on his experiences as consultant in ophthalmology, Air Force Headquarters, Ottawa. There was, he says, at the outset of the war little first-hand knowledge in Canada of the medical aspects of aviation. (One of the first problems was that of the medical selection of air crew). The problem was attacked by the formation of medical selection boards at each Initial Training School. These boards comprised several internists, an ophthalmologist, an oto-laryngologist and a neuro-psychiatrist. It was found that medical standards were fairly uniform for all members of air crew with the exception of the ophthalmic standards. "The ophthalmologist began to live a double life. On the one hand he interpreted the standards as accurately and honestly as he could, while on the other his curiosity got the better of him, and he began analysing and studying them. As a result a large number of studies were set up to evaluate the various ophthalmic procedures as tests and to correlate the ocular assessment so obtained with flying performance."

At the outset the Project-O-Chart was adopted as a standard means of measuring visual acuity. The Maddox Rod replaced the Red-green box, and it was found that the former gave more uniform results, especially in the hands of less skilled examiners. Tangent scales were developed, but it was found that the tangent scale used at reading distance, as in the Maddox Wing Test was grossly unreliable because of the great stimulus to the associated accommodation-convergence reflex.

Specifications for the manufacture in Canada of binocular gauges and the Bishop Harman diaphragm were drawn up. With the entry of Japan into the War the supply of Ishihara colour charts was lost. The book of charts of the American Optical Society was used instead. Those who failed were tested on a lantern. The R.C.N. colour lantern was evolved, and a distinct improvement in the situation resulted.

The question of aniseikonia and the rôle of orthoptics have also received attention. The R.C.A.F. ophthalmologists place most importance on visual acuity and colour vision. Night vision is tested by the rotating hexagon. A new spectacle frame designed for service conditions, and the incorporation of surface hardened lenses for air crew, and the development of a new protective goggle have all emerged.

The school of aviation medicine is described, and the re-organisation of the medical branch of the R.C.A.F.

The number of Medical Selection Boards has been reduced to two, and at each there is an ophthalmic "unit or cell" in close collaboration with other members of the board. The ophthalmic "cell" consists of an experienced ophthalmologist, two or three medical officers under instruction, and three or four female ophthalmic assistants. "At Medical Selection Boards there is an unexcelled opportunity to gain experince in physiological optics, ocular muscle balance, and refractions. . . . These Boards, therefore form an excellent starting point in a training programme."

R.R.J.

(3) **Falls, Harold F. (Ann Arbor, Michigan).—A word of caution in use of pentothal sodium in ophthalmic surgery.** *Arch. of Ophthal.*, Vol. XXXI, (old series, Vol. LXXXVIII), No. 2, p. 134, February, 1944.

(3) Pentothal sodium is becoming increasingly popular in ophthalmic surgery, and Falls, in this article, gives some warnings about complications attending its use. Coughing or sneezing occurred in about 10 per cent. of his cases, but this percentage was reduced by previous cocainisation of the eye. Apnoea occurred in 5 per cent. of cases, and in one of these, a patient with heart disease and generalised arterio-sclerosis, death occurred. When respiratory failure sets in, the author recommends artificial respiration by thoracic compression and the administration of a gas mixture containing not more than 40 per cent. of oxygen and 4-5 per cent. of carbon dioxide. If cardiac failure is imminent, 2-4 minims of adrenalin 1/1000 should be given intravenously. It should also be remembered that for intra-ocular operations the post-operative sequelae of pentothal sodium may be disastrous, since they include nausea, restlessness and vomiting.

F. A. W-N.

ORBITAL TUMOURS

BY

HARVEY JACKSON

This was the subject for discussion at a meeting of the Royal Eye Hospital Clinical Society held on November 5, 1943.

Mr. Holmes Smith, the Chairman, pointed out that considerable interest had been caused in ophthalmic circles by Dandy in his book on orbital tumours. He therein made the claim that the bulk of orbital tumours had intracranial extensions and should be dealt with by the neuro-surgeon through the transfrontal approach. Ophthalmic surgeons merely tinkered with the problem by explorations by Krönlein operations.

The Royal Eye Hospital Clinical Society wished to know the truth in this matter, and they had therefore asked a distinguished neurosurgeon to address them on the subject.

IN an accurate conception of the subject of "orbital tumours" material should be restricted to those tumours developing primarily within the precincts of the orbital cavity. The subject, however, is so intimately related with that of "unilateral proptosis" that the inclusion of invasions by juxta-orbital tumours is not only permissible but essential. So limited is the incidence of primary tumours that the approach to the problem of the one-sided exophthalmos is broached with tumour-sense somewhat repressed. Rather has the problem been stressed unduly in its relationship with thyrotoxicosis.

Two recent publications, Dandy's monograph on "Orbital Tumours,"[1] and a paper by Iles and Rendle Short,[2] are of particular interest. Their material, together with personal cases, afford a fairly representative collection, though by no means pathologically inclusive. A study of this compounded list manifests certain outstanding features which are to be considered.

Well may one enquire as to what influencing factors direct patients to solicit advice and how the clinical diagnosis of "orbital tumour" is to be reached?

The most frequent and commonly the earliest symptom is unilateral proptosis, wherein there occurs a progressive, non-pulsatile, irreducible axial displacement of the affected eye. A proportion of patients proffer that the proptosis varies in degree; a matter possibly not difficult to understand, say, in the presence of a growth of the lacrimal gland, whereby interference with secretion would afford an explanation, but otherwise of doubtful causation.

Can proptosis *per se* be significant as a dominant, or even final factor in the diagnosis? Rundle and Wilson,[3] working at the Westminster Hospital Medical School, have investigated the subject and offer evidence on which they have deduced that a difference of six millimetres or more between the prominences of the two eyes is exclusive of other lesion than tumour. Moreover,

these observers are of the opinion that something in the order of 90 per cent. of orbital tumours, on present-day diagnosis, exhibit this, or an even greater, degree of protrusion. Nevertheless it must not be assumed that invasion of the orbit by a tumour is indicated invariably in ocular protrusion—a point to which Dandy made particular comment in his reference to chiasmal gliomata.[4] On the other hand, the development of proptosis in a case of intracranial neoplasm does not of necessity indicate extension of tumour tissue into the orbital cavity.

Deviation of the eyeball in other directions is seen most often in a downward and outward displacement. This distortion the writer has encountered in tumour of the optic nerve, orbital pseudotumour, and mucocele of the frontal sinus.

In an analysis of individual symptoms encroachment on the incidence of proptosis is found in "visual disturbance." In fact, these two indicators, unilateral proptosis and defective vision, are often appreciated simultaneously. The form in which the visual derangement applies varies between deterioration of visual acuity, curtailment of the visual field and disruption of stereoscopic vision (diplopia). According to Parsons there is usually diplopia owing to interference with the mobility of the eye in optic nerve tumours.[5] However, diplopia is by no means a common manifestation: whilst in some patients this doubtless arises out of a suppression of vision, central in origin, more frequently is this avoided by virtue of the severity of direct interference with visual acuity.

How singular it seems that protrusion of the eye and disturbances of vision fail in their early realisation by the victim; indeed appreciation of their existence may be purely accidental. Well may this be appreciated from the fact that in one of my patients awareness of the undue prominence of the eye was established during the trying on of hats at the milliner's, likewise a second patient noticed the paucity of visual acuity in attempting to sight a rifle in the course of Home Guard exercises.

How essential it is for disturbances of vision to be analysed with care! A perfunctory dismissal of the visual fields as normal is not uncommon, whereas in reality a more meticulous examination, employing small test objects (1 and 2 mm.) and a Bjerrum screen, may reveal some limited yet none the less significant deficiency, circumferential or insular. Timely recognition of an intracranial extension of a tumour may well be the outcome of such an investigation. Duke-Elder states that mural infiltration affects the visual acuity but not the visual fields.[6]

An occasional patient is distraught with pain, although pain fails to play any very prominent part in the average history. This somewhat surprising freedom from pain probably finds explanation in the chronicity of the majority of the lesions. That pain may

hold important signification may be suspect from the outstanding part it played in one case under my care: by this one infers the likelihood that the underlying disease depends on an infective origin—a chronic granuloma or so-called "pseudo-tumour of the orbit."

The development of a mass discernible to the patient is of infrequent occurrence. More likely is it for a patient to observe an associated swelling of other parts, such as is found in the frontal or temporal region when a meningioma develops in the anterior fossa or about the sphenoidal ridge respectively. Some of the simple forms of tumour as seen in the more superficial planes of the orbit may gain early notice, *e.g.*, dermoid cysts and tumours of the lacrimal gland, According to Ridley and Sorsby, dermoids occurring at the outer and inner upper angles of the orbit, present as small, freely mobile tumours often containing hair.[7] To assume, therefore, that these tumours are always apparent and rest in superficial planes would be erroneous; indeed, two personal cases showed no surface change, apart from proptosis, in any way related to the orbital outlet. The one patient exhibited swelling in the temporal fossa, and both afforded evidence of implication of deeper orbital planes on radiological examination.

The above complaints represent the more usual clinical signs. Amongst other reasons for the attendance of the patient are ptosis, oedema of the lids, chemosis, cranial nerve palsies, audible bruits, or, as in one personal case, the formation of a discharging sinus resultant on secondary infection.

What does the ophthalmoscope reveal? Parsons in his "Diseases of the Eye" has condensed apparent changes in the statement that "papillitis may be present especially with optic nerve tumours, optic atrophy is common in other forms."[8] The material to hand confirms these impressions.

In the presence of tumours of the nerve papilloedema can reach high dimensions—the most advanced degrees observed personally in any case of cerebral or like tumour (12 to 13 D.). One of my cases depicted such change that it was not possible on clinical examination to differentiate between true papilloedema and a possible infiltrating state of the disc by tumour tissue.

Tumours arising primarily within the orbit either without, or within the muscle cone, have been productive of primary optic atrophy when any change has been discernible. With tumours invading the orbit, arising primarily in adjacent tissues, the disc changes have been found to represent those arising directly out of the primary lesion; hence sometimes primary atrophy is portrayed whilst at others there is papilloedema or consecutive atrophy.

The length of history may be astounding when fully established, but a true estimate is reached with difficulty owing to the failure of the change to engage the attention of the patient. Tumours of the nerve afford a history merely of weeks or perhaps months, but other tumours may, on revision, provide facts from which the duration may be gauged. A period of from twelve to twenty years is not exceptional. One patient previously mentioned as having noted the distortion of the eye when trying on hats, found the eye to be unusually prominent in a passport photograph that had been taken several years before.

How misrepresentative a small series of cases can be is evident in a review of the material at hand. One recalls Dandy's five cases of Schüller-Christian disease, Iles' and Rendle Short's four cases of haemangioma, and three cases of tumour of the optic nerve in my own experiences. That the diagnosis may be acceptable always is open to doubt, as incidenced in Schüller-Christian disease, for one personal case was reported on by another clinic as harbouring a tumour probably of such origin, the conclusions being formulated from a biopsy specimen. The mass finally proved to be of an epidermoid nature. A field of the histological section is included in this paper,

A review of ophthalmological literature is especially interesting, particularly in dealing with the problem of optic nerve tumours. Parsons states that most of these tumours are probably endotheliomata which have undergone degeneration.[9] Verification for such a comment is not forthcoming from the large series of cases collected by Hudson[10] and Mathewson.[11] In 211 cases of optic nerve tumours reviewed by these ophthalmologists :—

170 or 80·56 per cent. were gliomata.
33 or 15·63 per cent. were endotheliomata.
8 or 3·8 per cent. were fibromata.

Various points of clinical differentiation between gliomata and endotheliomata are rendered, but confirmation cannot be established from the data to hand. Certainly glioma of the nerve is a disease of the young (average 13 years—Hudson) and much commoner than meningioma (6 to 1—Mathewson).[12]

Radiological verification is forthcoming in a high percentage of cases of orbital tumour; manifest in erosion, sclerosis or hyperostosis of bone. From personal experiences it may be said that when the orbit is invaded from without, or when an orbital mass has extruded beyond the normal precincts of the orbit, radiographic confirmation is the rule. When a tumour produces expansion of the canalicular portion of the optic nerve the optic foramen enlarges, whereas mural infiltration encroaches upon the optic canal, thereby causing a concentric or irregular constriction. According to Clegg an optic canal measuring less than 2·8 mm.

in one of its diameters cannot contain a normal optic nerve.[13] In the diagnosis of "optic nerve tumour" the importance of a circular enlargement of the foramen in contrast with other outlines should be stressed. That asymmetry in the two foramina may be present without pathological bearing should be fully realised, for Clegg's observations indicate that absolute symmetry is found in but 45 per cent. of skulls.[14] Hudson has drawn attention to the fact that the optic foramen attains its full adult dimensions by the time a child reaches the age of three years.[15]

Generally speaking, clinico-pathological investigations do not afford data in confirmation of tumours restricted to the orbit, excluding such rarities as cysts of parasitic origin.

The presence of Bence-Jones protein in the urine as evidence of myelomatosis would clinch suspicions in a case of generalised osseous disease with orbital deposits.

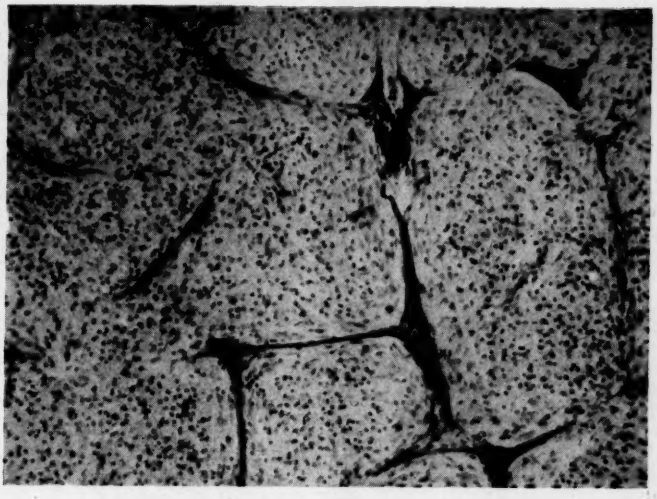
These considerations give some indication of the clinical-pathological aspects: the occasional fact, significant and assertive, yet of infrequent bearing. One essential examination in the presence of any lesion of expanding type is the Wassermann or comparable reaction.

Analysis of the cerebro-spinal fluid is commonly negative, but even this fact may be applied to contra-indicate the possibility of intracranial extension as by an optic nerve glioma (possible increase in total protein content when sub-arachnoid space is infringed). Again, the lack of protein in excessive quantities in the presence of an orbital mass with intracranial extension may bear pathological significance. (A meningeal tumour may cause considerable exudation of protein into the cerebro-spinal fluid, whereas an epidermoid would not induce such a change.)

The formation of an inflammatory mass may be associated with suggestive or confirmatory alterations in the blood picture, as would invasions of the orbit by certain blood diseases.

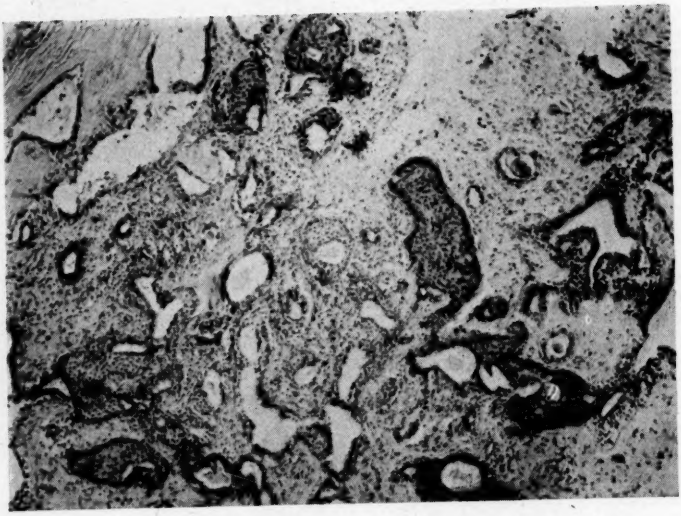
Operative treatment having been elected, there remains the selection of the operative route to be adopted. Little difficulty arises when dealing with anteriorly and superficially placed lesions that lend themselves to easy exposure from the front and through the eyelid or the conjunctival sac. For the more deeply situated and so less easily approachable tumour the choice of exposure lies between the lateral route, or Krönlein type of attack; and the transcranial operation, wherein a frontal osteo-plastic flap is reflected, as in operations on the pituitary region, and the orbit explored through its roof.

In my opinion the Krönlein operation with the limited field it provides, the diplopia that so frequently ensues, and the unsightly scar that it leaves, has little to be offered in its favour. On behalf of the transcranial operation, the final scar

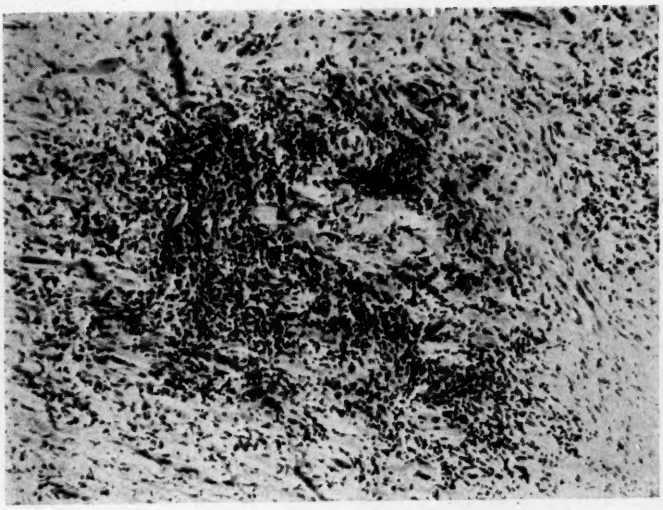


Section of glioma of the optic nerve (astrocytoma).

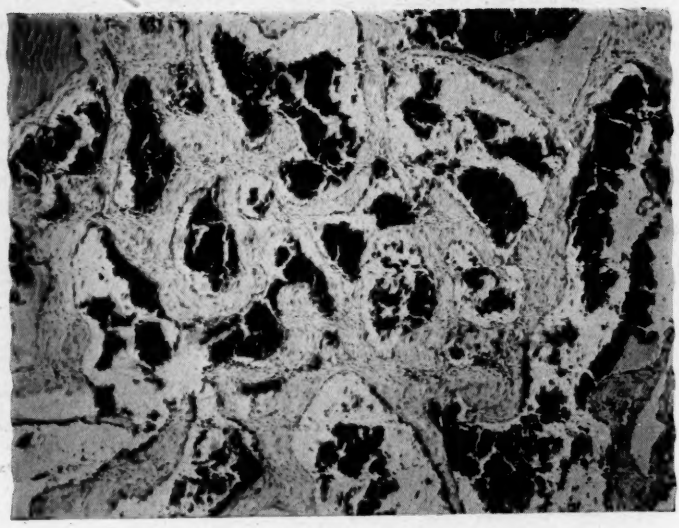
Section of dermoid tumour showing a follicle and sweat gland.



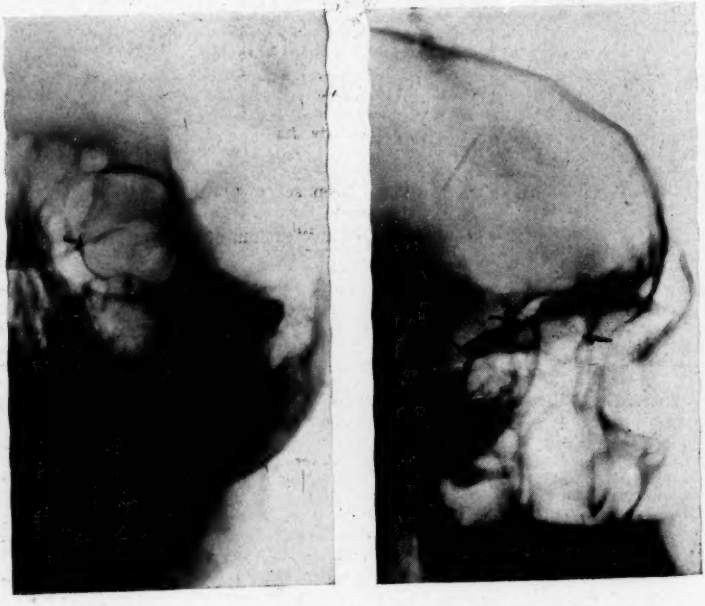
Section of mixed tumour of the lacrimal gland.



Section of a granuloma or pseudo-tumour of the orbit.



Section of haemangeioma of orbit.



Radiographs showing erosions of the orbital wall by dermoid tumours.

is completely hidden, a much wider exploration of the orbit is available, and for those cases wherein the tumour extends from beyond the orbit into the cranial cavity, no other mode of attack could prove adequate. The risk of this formidable undertaking has been cited as a contra-indication to its employment, but at the hands of a trained neurosurgeon this can be discounted. That an unsightly distortion of the eye of pulsatile character is the result is entirely false, as is apparent from the post-operative results demonstrated this evening.

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14. *Ibidem.*
15. HUDSON, A. C. (1912).—*Roy. Lond. Ophthal. Hosp. Reps.*, Vol. XVIII, p. 317.
16. GOALWIN, H. A. (1927).—*Jl. Amer. Med. Assoc.*, Vol. LXXXIX, pp. 21, 1745.

Before the paper Mr. Jackson demonstrated several interesting cases of orbital tumour. These included a child from whom he had removed a glioma of the optic nerve seven years previously. He also showed a lady operated on in 1938 for an orbital astrocytoma. Another lady had had proptosis for twenty years with anaesthesia of the 5th nerve area. He removed an epidermal tumour of orbit which extended back into the cranial cavity. He also showed a case in which a haemangioma of the left orbit had been successfully excised. In another case an orbital tumour had been diagnosed; but on operation nothing of the sort was found, but an optic nerve narrowed by inflammation.

Dr. Rundle demonstrated a case of Graves's disease in which one eye was more prominent. There was lid retraction with unilateral spasm of the levator palpebrae superiosis.

Mr. Lindsay Rea stated how much he had appreciated Mr. Harvey Jackson's lecture. He felt a feeling of humility, because among Mr. Harvey Jackson's cases he saw two who had been in his own charge years previously. He had not diagnosed orbital tumour at the time, though now the condition was obvious. He had recently assisted a well-known neurosurgeon in the removal of an orbital tumour, and he found himself being complimented on the great care he took of the eye. This seemed to surprise the surgeon, and he thought it showed how important it was for the neurosurgeon to have an ophthalmologist in intimate collaboration with him in these difficult cases.

Mr. L. H. Savin said he wished to say how much he had enjoyed the lecture. When he read Dandy's book he thought that the cases described were not quite an average sample of orbital tumours. Perhaps cases with intracranial involvement tended to get referred to Dandy. Mr. Savin privately thought he would continue to explore these cases by Krönlein's operation, with which he had been successful in five cases in getting adequate exposure and removing the tumour.

After seeing Mr. Harvey Jackson's cases he saw he had been wrong. The cases just demonstrated were so very much better than Krönlein cases from the

cosmetic point of view. By the transfrontal route there was no ugly temporal scar as in his own cases.

Mr. Harvey Jackson had mentioned orbital dermoids, and he (Mr. Savin) had one in his own series. It caused great proptosis, and unfortunately in the course of removal of the tumour he had produced a ptosis and weakness of the superior rectus, later rectified with great difficulty.

He had had a case of psammoma of the optic nerve sheath. He removed the tumour successfully, and later the patient developed symptoms from what turned out to be multiple intracranial meningiomata.

Mr. Harvey Jackson had mentioned pseudo-tumours of the orbit. Some time ago Mr. Savin was called to a municipal hospital to remove an eye in which there had been perforation of an infected corneal ulcer. The eye was much protruded, and after enucleation this was found to be due to a large rounded orbital swelling behind the globe. Later investigation showed this to be a case of "pseudo-tumour."

Mr. Jackson had mentioned 5th nerve pain as a prominent feature in pseudo-tumours. He wondered if there was any connection with those cases of periostitis of the sphenoidal fissure which Dr. James Collier was so fond of demonstrating in the old days at the Royal Eye Hospital. In these cases there was severe 5th nerve pain, limitation of ocular movements, and often proptosis. He had seen them follow dental extractions and tonsillectomy.

Mr. Hughes spoke of difficulties in discriminating between orbital tumours and other causes of proptosis such as exophthalmic ophthalmoplegia. In tumour cases the fields were always affected. He had seen over twenty explorations of orbit by the transfrontal route. In Mr. Jackson's hands it was a safe procedure.

Mr. Harvey Jackson, in reply, said he whole-heartedly agreed with Mr. Lindsay Rea that the ophthalmologist was an indispensable person on a neurosurgical unit. He, too, had seen psammomata associated with meningiomata elsewhere. He thanked everybody for their kind remarks.

BOOK NOTICE

The Lighting of Schools, Principles of Good Lighting, The Lighting of Public Buildings. From The Illuminated Engineering Society, 32, Victoria Street, London, S.W.1. Price, 1/- each, 9/- a dozen, £3 a hundred.

These pamphlets, illustrated by thumb nail sketches, have been published for the benefit of government departments, local authorities, borough engineers, architects and others engaged in solving the lighting problems which will arise in the period of post war reconstruction.

The pamphlet most valuable to the ophthalmic surgeon, is that dealing with the lighting of schools, since it contains among other useful information a table giving the illumination in foot candles recommended for various types of work. This is a matter about which we are often consulted, and expected to have some precise information. Hints are also given as to the proper situation and types of light sources, the treatment of surfaces such as walls, ceilings and blackboards, and the maintenance of lamps and windows. It is not generally realised, for example, that the combined effect of the accumulation of dust and dirt on lighting fittings and on walls and ceilings, may reduce the available illumination by as much as 20-30 per cent. in six weeks.

The other two booklets are concerned mainly with emphasising the need for adequate lighting in the performance of various visual tasks, and giving theoretical and practical reasons to justify the statement that "every citizen should have good light as a matter of right."

CORRESPONDENCE

TONOMETRY

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—When I read the "correspondence" by Dr. John Foster in the March, 1944, issue of your journal, it came to my mind that the suggestion made by Dr. Foster about correlation of palpation performed by different members of a clinic has been carried out some 14 years ago in the Basel Eye Clinic, under the sponsorship of Prof. Brueckner.

H. K. Mueller of the University Eye Clinic of Basel, Switzerland, published the results of thousand palpatory estimations of intra-ocular pressure performed by five physicians of this infirmary in 1930. The estimated figures were compared with those obtained by the Schiötz tonometer on the same eyes at the same examination. Thirty-three per cent. of all estimations were either too high or too low in comparison to the tonometer reading. The average deviation was, for the values between 5 and 10 mm. Hg, 9·4 mm. Hg; for the values between 21 and 25 mm. Hg, the deviations averaged—amazingly low—4 mm. Hg; and between 51 and 90 mm. Hg, they were 18·3 mm. Hg. Usually, low pressure values were over-estimated, and high pressures were under-estimated. If there was a difference between the pressure in the right and in the left eye of the same individual the physicians miscalculated it in 36 per cent. of all estimations believing the softer eye to be the harder one. Still worse were the results obtained when, after a few hours interval, the same eye was examined by the same person.

Very truly yours,

K. W. ASCHER.

2508 AUBURN AVE.,
CINCINNATI, OHIO.

NOTES

Council of British Ophthalmologists

As announced in our last issue, the Council of British Ophthalmologists, in response to the invitation of the President and Council of the Royal College of Surgeons, submitted the names of six ophthalmic

surgeons from whom the Royal College might select one for co-option on to its Council. The Honorary Secretary of the Council of British Ophthalmologists has received notice that Mr. George Black has been chosen. Mr. Black thus becomes co-opted member of Council, Royal College of Surgeons, representing ophthalmology, for the ensuing twelve months.

* * * *

Addendum

IN Major Stern's article on Marfan's Syndrome, p. 232, the following sentence should be added after the bracket near the end of the paper.

"The small sella has been observed before by several authors (Coppez, Hambresin et V. D. Maele, Morard, Killmann, Viallefont et Temple, Fleischer); others found the sella normal or slightly enlarged."

The following references should be added to the bibliography:—

COPPEZ.—*Soc. belge d'ophtal.*, Vol. LXVII, p. 102, 1933.
MORRARD, G.—*Arch. d'ophtal.*, Vol. LII, p. 344, 1934.
KILLMANN.—*Klin. Monats. f. Augenheilk*, Vol. XCII, p. 335, 1934.
VIALLEFONT ET TEMPLE.—*Arch. d'ophtal.*, Vol. LI, p. 536, 1934.
FLEISCHER.—*Münch. Med. Wochenschr.*, Vol. XVI, p. 3, 1928.

Illustrations of the first pair of brothers are appended.

Finally, gratitude is due to Prof. A. Feigenbaum and Brigadier G. I. Scott.

* * * *

University of Glasgow Department of Ophthalmology. Autumn 1944

IN September a series of meetings will be held in the department on Wednesdays at 8 p.m. The general arrangements will be similar to the series held last year. Tea will be served after the paper, and a discussion will follow. The meetings will be open to all medical practitioners and senior students interested in ophthalmology.

September 6.—Professor W. J. B. Riddell: "Small scale ophthalmic investigations."

September 13.—Professor A. Loewenstein: "Hypertensive retinopathy."

September 20.—Dr. Catherine Williamson: "Ophthalmic experience in the Far East."

September 27.—Dr. John Marshall: "Heterophoria."

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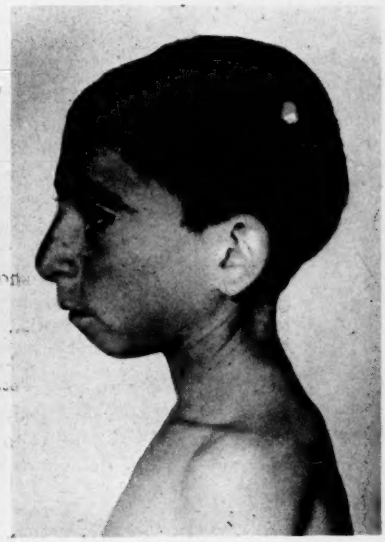
Special Notice

WE are asked by the Ministry of Information to state that the fact that goods made of raw materials in short supply owing to war conditions are advertised in this journal should not be taken as an indication that they are necessarily available for export.

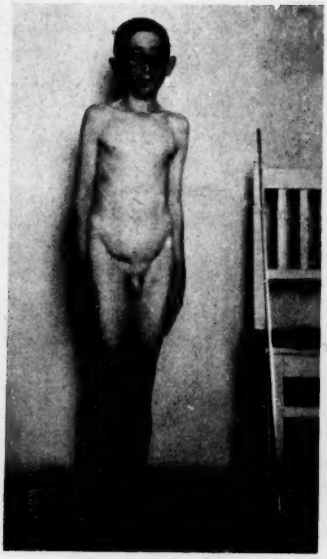
Illustrating Major Stern's article on MARFAN'S SYNDROME, p. 229

Elder brother of first pair



Younger brother of first pair

Coloboma of iris in elder brother of first pair



Elder brother of first pair

Younger brother of first pair

To illustrate MARFAN'S SYNDROME, p. 229